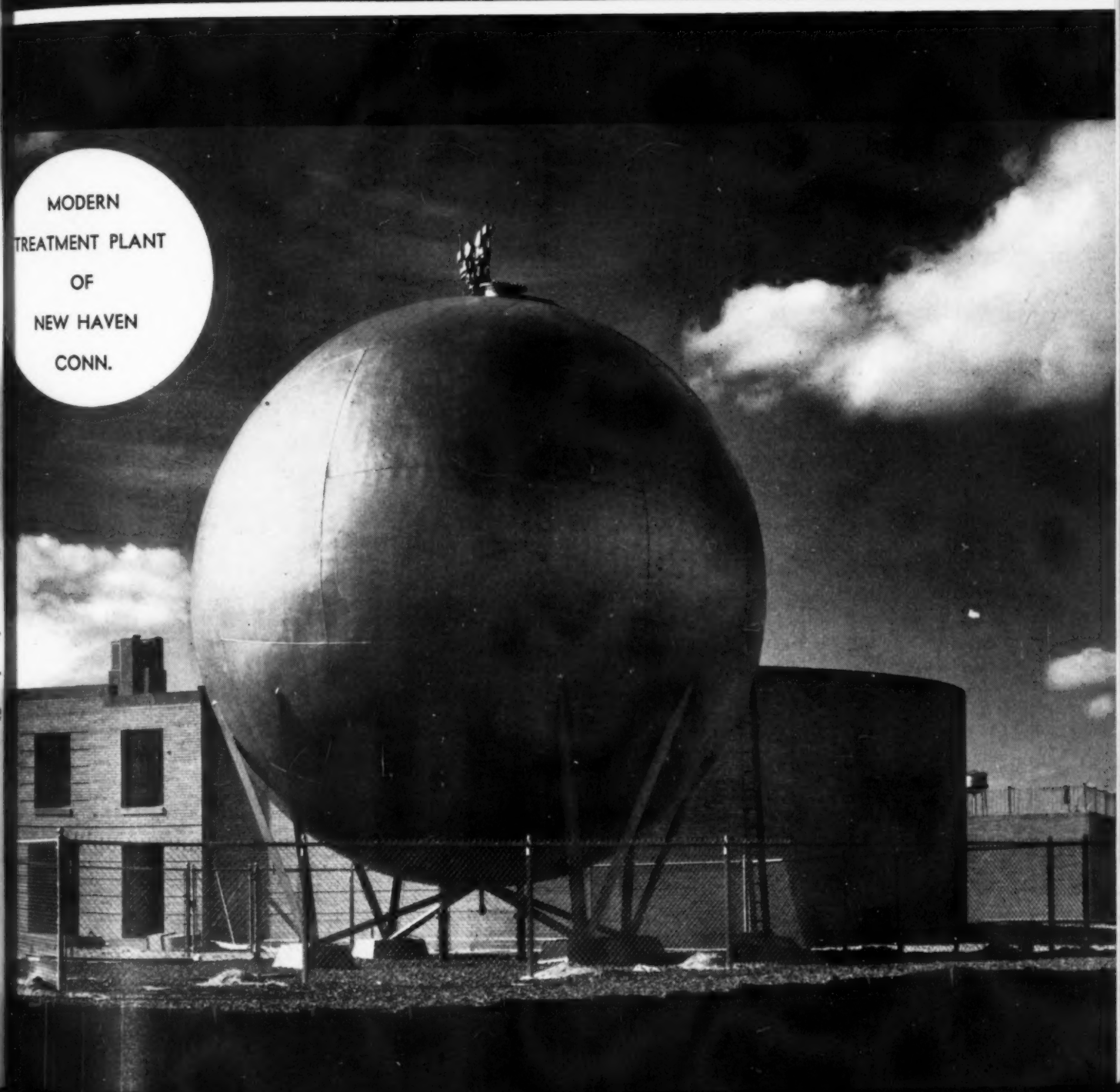
WATER & SEWAGE WORKS



CHAPMAN

DOW DISC-ARM PIVOT VALVES

PROVEN

STRENGTH and RELIABILITY

For Over 25 Years

In successful operation for over a quarter of a century, Chapman Dow Disc-Arm Pivot Valves are an *improved* type of butterfly valve. They combine the advantages of simplicity, strength, reliability, and tightness. Illustration shows the disc in the *open, partly open,* and *closed* positions. It will be seen how, by applying the operating force to the proper point, the deflection is taken out of the lower half of the disc.

THE CHAPMAN VALVE MANUFACTURING COMPANY

INDIAN ORCHARD, MASS.

Write for bulletin containing complete engineering data and recommendations.

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. July, 1948. Volume 95. Number 7. Published monthly by Gillette Publishing Co. at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c; except *this issue*, 75 cents. Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second-class matter March 4, 1948, at the post office at Mount Morris, Illinois, under the Act of March 3, 1879. Executive and Business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N. Y.

Precision Engineered for Long, Hard Service

15 Years of Service . . . Over 1700 Installations

THE COMMINUTOR

Is Specifically Designed to Screen and Cut Sewage Solids Under Water

From the Mediterranean to the Philippines; from the Arctic Circle to Australia, wherever there is modern sewage treatment, you will find Comminutors. Such world-wide acceptance is based on a machine that efficiently and effectively performs a service unmatched by any other type of equipment.

The Comminutor, compact, economical, silent, does away with the need for screens, rakes, grinders, burial pits and incinerators or other means of destroying the filth that is obtained by the old methods. With no screenings to stand in the open, there is no odor, no additional labor, and none of the unsightliness usually connected with screenings and their disposal.

The sturdy construction of the Comminutor is the result of long experience. The drum is a single casting, precision machined to close tolerances. Cutting bars, combs and teeth are firmly seated, yet easily removable for sharpening or replacement. They are staggered and distributed to effect multiple small shearing actions. This, plus inertia of the drum in motion, and gearing, allows use of small motors with consequent power economy. No housing is required for the Comminutor.

The Chicago Pump Company Comminutor is the result of many years of research and trial. "Bugs" in early models have long been eliminated so that the machines in use for many years have established an incomparable record of successful performance in the field.

If you have work in the sewage treatment field, write today for the Comminutor Bulletin which gives complete engineering data.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM ST. CHICAGO 18, ILLINOIS

• COMMINUTORS • SWING DIFFUSERS •
• FLUSH-KLEENS • 'PAKAGE' PLANTS •
SCRU-PELLERS • SAMPLERS • NON-CLOG PUMPS

...only

offers all 8 of these advantages

Each of these characteristics is essential to a good water supply line, and Lock Joint Reinforced Concrete Pressure Pipe alone offers ALL 8 OF THESE ESSENTIAL QUALITIES.

LOCK JOINT PIPE COMPANY

Est. 1905

P.O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J. • Turner, Kan.

BRANCH OFFICES: Cheyenne, Wyo. • Denver, Colo. • Kansas City, Mo. • Joplin, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING

Service Lines as a Factor in Taste and Odor Production

Is an article which will interest a high per cent of our readers. No better preview of this article can be given than that revealed in its title. Those who have read earlier articles by this author will be on the lookout for this one by—

CARL WILSON,
Water Supply Technologist,* Los Angeles.
*Former Chief Chemist, Los Angeles Dept. of Water Supply.

Liquid Digested Sludge

Has proved to be profitable to both the Indiana farmers who use it as fertilizer, and the Marion (Ind.) Sewage Treatment Works which sells it. This method of disposal compares favorably in cost with chemical treatment and filtering. This complete and interesting story of the marketing of "Liquid Farm Fertilizer" is told by one of Marion's leading citizens—

DAVID BACKMEYER, Supt.,
Water & Sewage Works, Marion, Ind.

Our Relations Are Always With Us—

So says the writer of this open letter to Doc Symons in answer to his query, "How Are Your Relations—Public, That Is?" Done in the highly readable style of personal correspondence, this "letter" tells how the art of public relations is practiced by—

JOHN E. KLEINHENZ, Publicity,
Indianapolis (Ind.) Water Co.

Sludge Pumping Through Long Force Mains

Constitutes what is believed to be the first article of its kind ever published. For a number of years we have tried to get the story of Cleveland's experiences in pumping undigested sludge a long distance through a force main for digestion at another plant. We can now promise these valuable experiences and recommendations covering pumping practices and maintenance of the long force main as recorded by—

JOHN J. WIRTS, Ass't Constr. Engr.,*
Div. of Sewage Disposal, Cleveland, Ohio.
*Former Supt. of the Easterly Treatment Plant, Cleveland.

Operation of Small Filtration Plants

Is the subject of a current series of short articles dealing with the operation and maintenance of small filtration plants by an author who has had considerable experience—

A. E. CLARK, Gen'l Mgr.,
Nashville (Tenn.) Suburban Util. Distr.

Cutting Cast-Iron Pipe

Is a paper which compares the better known methods of cutting cast-iron pipe and relates an improved method which involves simple electro-welding technic materially speeded up by the use of oxygen in the cutting arc. Considerable saving of time and materially reduced cost of making cuts is reported by—

SHERMAN L. ROGERS,
Supt. of Distribution, Hartford, Conn.

Method for Studying Toxicity of Industrial Wastes

Has been a desirable thing for some time, inasmuch as industrial waste treatment problems are becoming more and more important. The effects of industrial wastes on the all important B.O.D. test may be determined by means of the direct oxidation method according to—

H. HEUKELEKIAN, Associate,
Dept. of Water & Sewage, Rutgers Univ., N.J.

Associate Editor
GEORGE E. SYMONS, Ph.D.

Editorial Associates
J. R. BAYLIS
A. M. RAWN
H. A. FABER

Adv. Editor
H. J. CONWAY

Make-Up Editor
L. D. SANDERS

VOL. 95, NO. 7 **CONTENTS** JULY, 1948

Digestion of Sewage Solids, Part 4 237
By LeRoy W. Van Kleeck
Hartford, Connecticut

Continued Report on A.W.W.A. Atlantic City Convention 243

Chart for Determining the Grade of a Road, Walk, Ramp, etc. 252
By W. F. Schaphorst
Newark, New Jersey

Operation of Small Water Filtration Plants, Part VI 253
By A. E. Clark
Nashville, Tennessee

The Effect of Uncontrolled Logging on Stream Turbidity 255
By J. A. Lieberman and M. D. Hoover
Asheville, North Carolina

Water Purification Division Holds Three Sessions 259
A report by Harry A. Faber
Editorial Associate

Cleveland's New Water Intake 265
By Frank J. Schwemler
Cleveland, Ohio

Oxnard, Calif. Utilizes Sewage Treatment By-Products 267
By Orrin L. Isham
Oxnard, California

White Water Treatment and Recovery, Part II 268
By Willem Rudolfs and Earl J. Axe
Rutgers University

Trickling Filters for Treating Pulp and Paper Mill Wastes, Part I (Concluded) 271
By Harry W. Gehm
New York, New York

Meetings Scheduled 84A

"Here and There" with Doc Symons 86A

Manufacturers' and Equipment News 93A

Literature and Catalog Reviews 103A

Publication Office, 404 N. Wesley Ave., Mt. Morris, Ill.

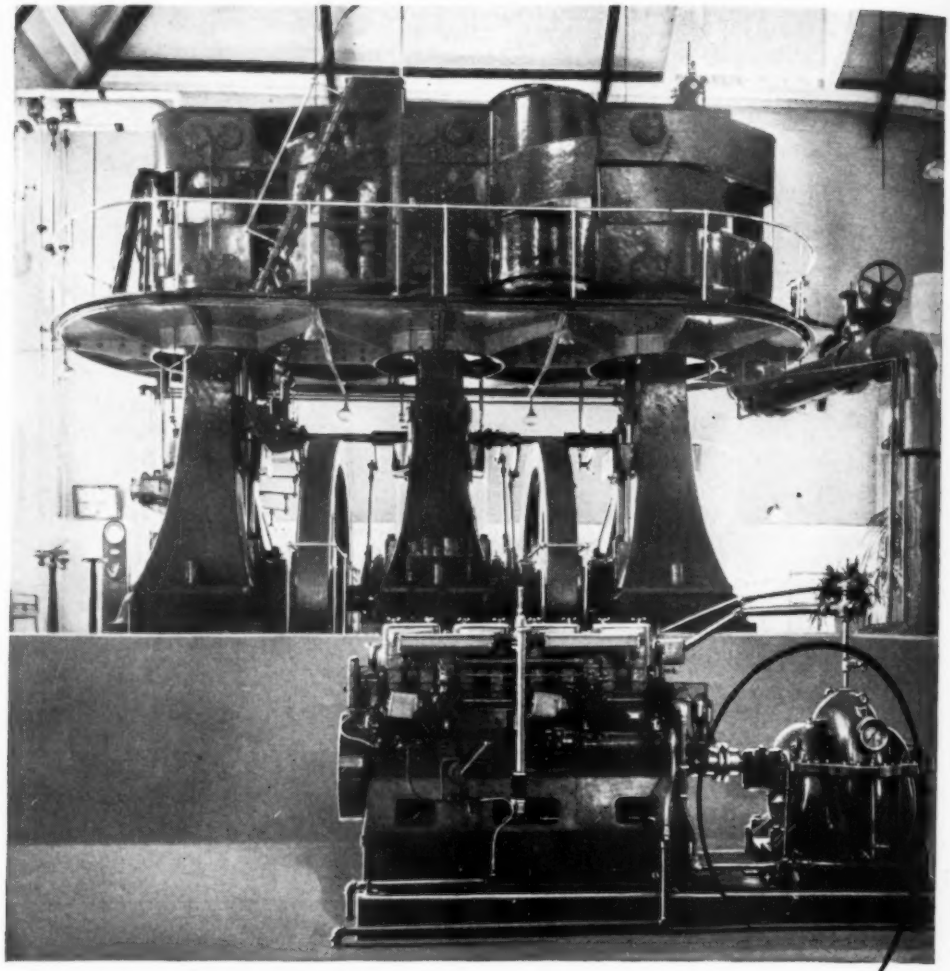
BUSINESS OFFICE
22 W. Maple St., Chicago 10, Ill.

EDITORIAL OFFICE
155 E. 44th St., New York 17, N. Y.

H. P. GILLETTE, Pres.; E. S. GILLETTE, Vice Pres.; L. H. ENSLOW, Vice Pres.

New York Office.....J. M. Angell, Jr., Mgr., 155 E. 44th Street
Chicago Office.....R. T. Wilson, Rep., 22 W. Maple Street
Cleveland Office.....Lee B. McMahon, Mgr., Leader Bldg.
Los Angeles Office....Don Harway, Rep., 1709 W. Eighth Street

WATER AND SEWAGE WORKS is a monthly publication. Single Copies, 25c; Subscription Rates, U. S. and Canada, $2 per year; Foreign, $3.
(Member—Audit Bureau of Circulation and Associated Business Papers.)



New De Laval Centrifugal Pump

REPLACES OBSOLETE GIANT

as Atlantic City modernizes

Replacement of the old triple-expansion pumping engine, shown in the background with the new De Laval centrifugal pump in the foreground, is part of the modernization program for Atlantic City. This station now employs a total of seven De Laval centrifugal pumps having a combined capacity of more than 73 million gallons daily. Four of these are motor-driven pumps employed for practically continuous operation while three are gasoline engine-driven pumps employed for stand-by service. All seven units are equipped with self-priming systems so that they can pick up the load upon a minute's notice.

DE LAVAL

DE LAVAL STEAM TURBINE CO., TRENTON 2, N.J.

Atlanta • Philadelphia • Los Angeles • Chicago • Pittsburgh • San Francisco
St. Paul • Cleveland • Tulsa • Boston • Charlotte • Detroit • Seattle • Toronto
New York • Kansas City • Vancouver • Rochester • New Orleans • Edmonton
Denver • Salt Lake City • Winnipeg • Helena • Houston • Washington, D. C.

WW-4

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

TRAFFIC CONTROLS

for San Diego water supply

fitted with *Everdur* AND BRONZE

Key parts of these 36" and 42" butterfly valves are made of Everdur and Bronze. Valves made by Coldwell-Wilcox Division of Krajewski-Pesant. Hydraulic Engineer for the city of San Diego: Fred D. Pyle.

DOWN from the Alvarado Regulating Reservoir rushes the water supply for San Diego, California, under 100 lb. pressure. Among the controls for this man-made underground river are these two butterfly valves, 36" and 42" I.D., which together weigh 16,000 lbs.

Many vital parts of these valves are made of Everdur* Copper-Silicon Alloys to insure long, dependable service. The shafts (respectively 5" and 5½" diam.) and seating rings in the body and in the disc are of Everdur. The ⅝" seating rings are fastened with Everdur screws. The stuffing box followers are of bronze with Everdur bolts throughout.

Why was Everdur chosen for this critical service? Because these famous alloys have proved thoroughly reliable in hundreds of water and sewage works applications. As a group, Everdur Alloys combine excellent corrosion resistance with high tensile strength, high fatigue limit, and good workability by all methods, including welding.

It pays to be familiar with the many ways in which you can take advantage of Everdur Alloys. For detailed information, write for Publications E-11 and E-5. 48184

*Reg. U. S. Pat. Off.

ANACONDA
from mine to consumer

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

An Official Survey

Your first reaction to the statement on the opposite page may be—"remarkable if true." For it *is* remarkable but it is also true. And it is backed by the findings of an official survey sponsored by three water works associations.

This recently completed survey shows that of all the cast iron water mains, in sizes 6-inch and larger, ever laid by 25 cities, large and small, from Canada to Florida, *96% are still in service.*

The cities were selected, and the survey directed, by a Joint Committee representing the American Water Works Association, the New England Water Works Association, and the Institute of Water Supply Utilities. The achieved purpose was to ascertain the actual length of life of various water works facilities—mains, valves, hydrants, pumping equipment, etc.

Mr. Q-Check says:
Alexandria, Virginia, laid its first cast iron pipe in 1852 and 99% of all sizes laid from that date is still in service.

The findings are reported in detail for each city in a book published by the American Water Works Association, which ought to be "must reading" for almost everyone connected with the water works industry. Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 122 South Michigan Avenue, Chicago 3, Illinois.

P. S.: If you are interested primarily in the survey findings as they pertain to cast iron water mains send for our brochure "Survival and Retirement Experience with Cast Iron Water Mains."

CAST IRON PIPE

Backs This Statement

96%

Still in Service

Alexandria, Virginia
Babylon, New York
Clinton, Iowa
Clyde, New York
Denver, Colorado
Des Moines, Iowa
Detroit, Michigan
Huntington, W. Va.
Jamaica, New York
Merrick, New York
Norwich, New York
Ottawa, Ontario
Philadelphia, Pennsylvania
Portland, Maine
Rochester (Suburban), N. Y.
St. Mary's, Pennsylvania
St. Paul, Minnesota
Sag Harbor, New York
Scranton, Pennsylvania
Springfield, Massachusetts
Summit, New Jersey
Syracuse (Suburban), N. Y.
Utica, New York
West Palm Beach, Florida
Winnipeg, Manitoba

SERVES FOR CENTURIES

That's CHICAGO . . . and Her Reliable Public Works Are Widely Equipped With Allis-Chalmers Products

WORLD LEADER in meat packing, rail transportation, lumber and a host of industries, Chicago today is the hub of America's Great Lakes inland empire. Her social, economic and cultural influences have shaped much of the character of the Middle West. Refusing to rest on past laurels, huge Chicago seeks greater triumphs in her civic future.

* * *

For over 50 years Allis-Chalmers equipment has performed with *outstanding dependability* in Chicago's public works. The confidence her engineers place in "A-C" is demonstrated by the installation of eight Allis-Chalmers pumps in the city's new 320 mgd filtration plant.

This reliable *equipment-engineering* is typical of what Allis-Chalmers can do for *large, medium* or *small* cities. Call our nearby office or write: ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2259

Have you received your copy of NEW bulletin 25B6607, "A-C Equipment for Public Works"?

Photo Courtesy of: Chicago Park District

Turbines . . . other power generation equipment.

Transformers — all types and sizes 1½ kva and up.

Unit substations — available in any practical size.

Motors 1 hp and up; controls; V-belt drives.

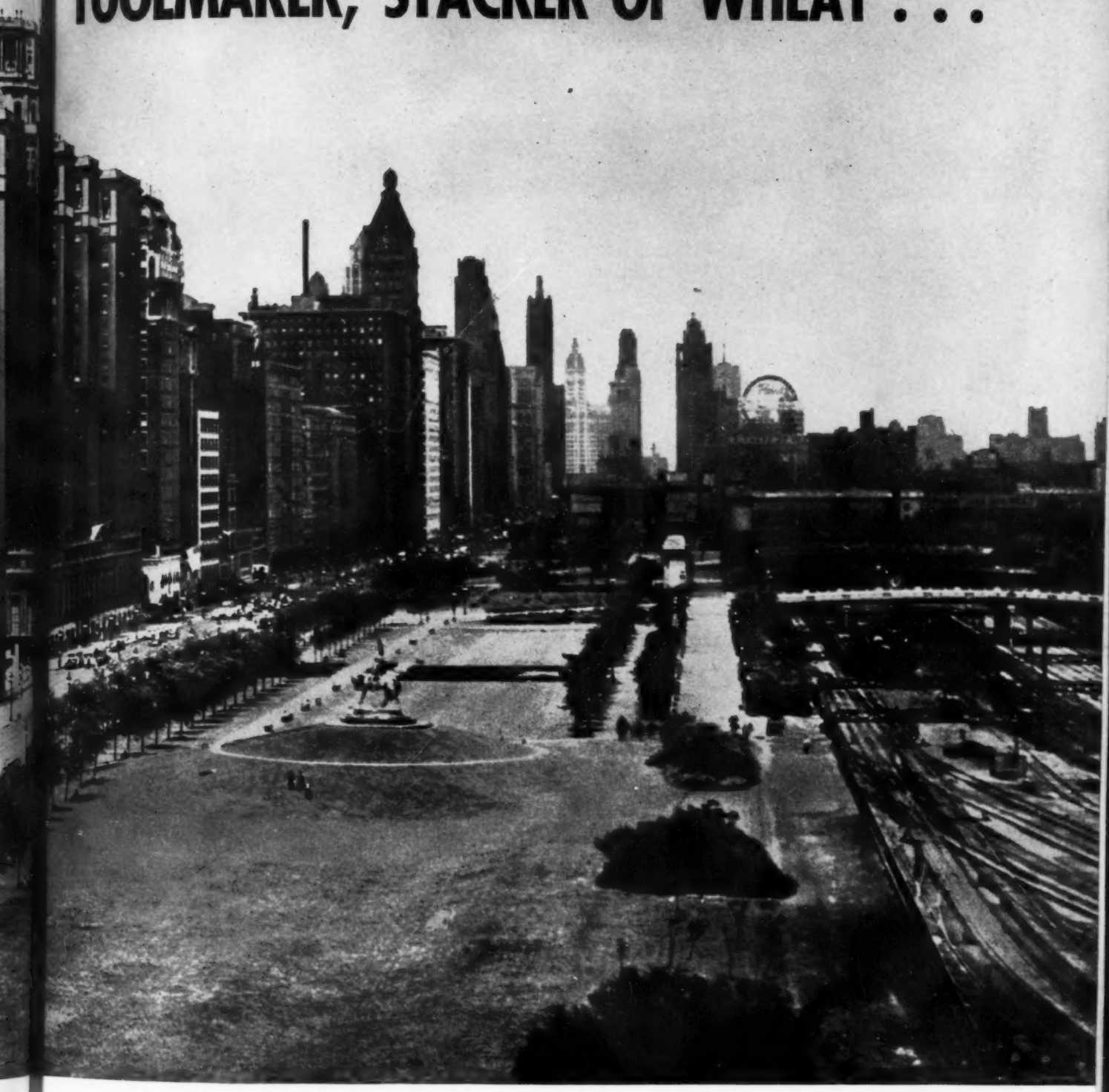
ALLIS

A CENTURY OF SERVICE to Industry THAT MADE America Great

One of the Big 3 in Electric Power Equipme

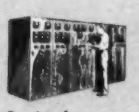
Butcher for the World,

TOOLMAKER, STACKER OF WHEAT . . ."

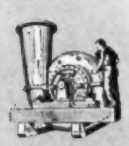


CHALMERS

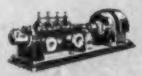
Biggest of All in Range of Industrial Products!



Switchgear; power distribution equipment.



Blowers, compressors in most sizes to fit all jobs.



Centrifugal pumps; types, sizes to 160,000 gpm.

Painted for U. S. Pipe & Foundry Co. by Paul Laune

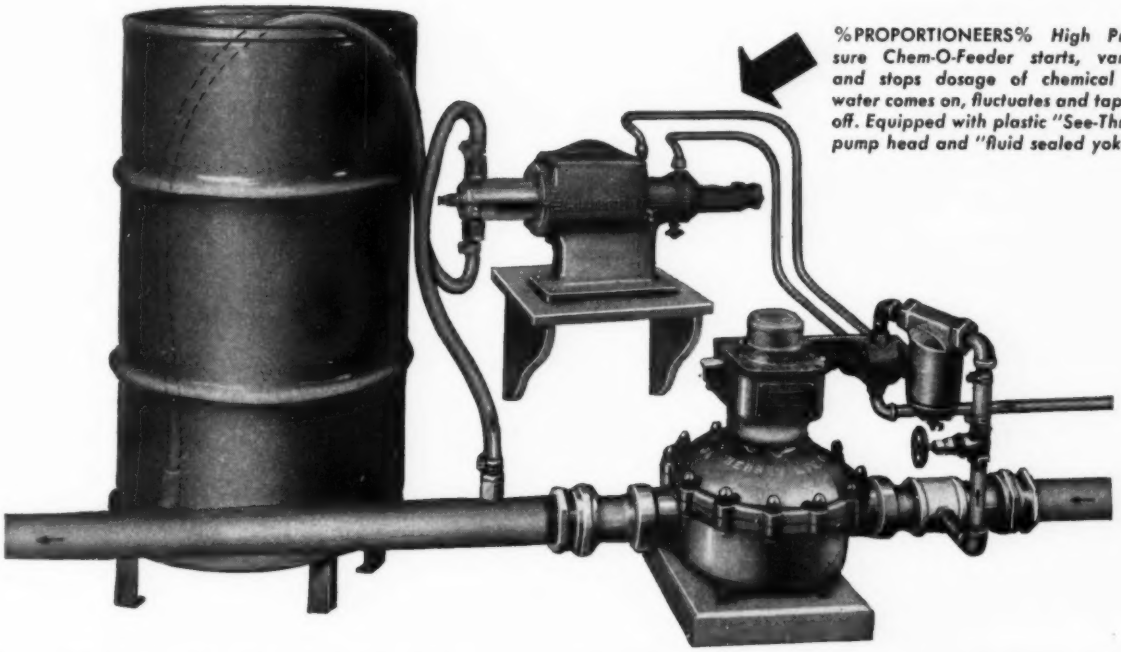
U.S. PIPE

THE quality of U. S. Cast Iron Pipe is controlled to a degree undreamed of by pipe founders a generation ago. Before the molten metal is poured into the mold of a Super-deLavaud centrifugal casting machine the important characteristics of the iron have been determined by our metallurgists. After the pipe has been cast our plant and research laboratories conduct numerous tests, in addition to acceptance tests, to assure the maintenance of quality in U. S. Pipe. This routine procedure at our several plants is enforced so that *we* may be confident that *your* confidence in our product continues to be justified. **United States Pipe and Foundry Co., General Offices: Burlington, New Jersey, Plants and Sales Offices Throughout U. S. A.**

WATER WORKS MEN *are smarter than people!*

MOST people think any clear water is safe to drink but water works men know better! They realize that water to be safe must be properly chlorinated—and they won't tolerate dangerous undertreatment or the disagreeable taste resulting from overtreatment.

%Proportioneers% Automatic and Proportional High Pressure Chem-O-Feeder has long been the favorite of wise water works men . . . paced by standard water meter, it automatically injects just the right amount of treating chemical at just the right time. No external source of power is required: the Chem-O-Feeder is hydraulically driven by the water in the main itself. Even when pressures are as high as 200 lbs. per sq. in. and the flow varies from minute to minute, the Chem-O-Feeder provides precise, dependable water treating. Other %Proportioneers% units are available to meet every operating condition. Information on request.



%PROPORTIONEERS% *High Pressure Chem-O-Feeder starts, varies and stops dosage of chemical as water comes on, fluctuates and tapers off. Equipped with plastic "See-Thru" pump head and "fluid sealed yoke".*

% PROPORTIONEERS, INC. %

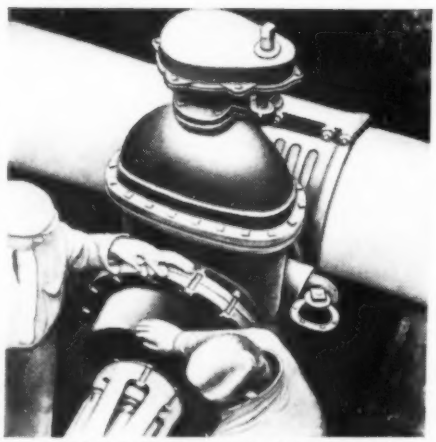
9 N. CODDING ST., PROVIDENCE 1, R. I.

Engineering Facts about
Johns-Manville TRANSITE PRESSURE PIPE
Making Large Service Connections

READY adaptability to standard waterworks practice is an advantage of Transite* Pressure Pipe which is of special importance when making large service connections. Thousands of such connections are in service today, installed in Transite supply and distribution lines with standard equipment and tools under a variety of installation and working conditions.

For tapping the line under pressure, conventional tapping sleeves, tapping valves and drilling machines are generally used. The sleeves are first leaded and caulked in the usual manner. Sleeves to fit all sizes of Transite Pressure Pipe are available from several manufacturers. Tough and strong, the pipe wall is, nevertheless, readily drilled; Transite's unusual machinability assures a clean cut.

In cases where the line can be temporarily removed from service, a commonly used method of providing large connections is to insert into the line a fitting† such as a tee having the required outlet size. To do this, a section of pipe is first removed from the line. The Simplex Coupling permits quick removal and with a minimum of trench excavation. Two stubs of pipe are then cut from this section and inserted into the bells of the fitting to form an assembly of equivalent length to that of the section removed. No problem arises in joining stub ends and fitting, since lead or compound joints are readily made with Transite. Replacement of the assembly in the line is easily and quickly made with the standard Simplex Couplings.



A 24-inch Transite main being tapped under full working pressure for a 20-inch branch connection.

A method sometimes used for making connections when the line is under pressure is the use of service clamps of the type equipped with double straps. These may be used for making service connections larger than those recommended for corporation stops inserted directly into the wall of the pipe or where multiple corporation stops are not used. After the service clamp and corporation stop are attached, the pipe wall is drilled with conventional drilling tools. Service clamps are not used for outlets exceeding one-quarter the diameter of the street main, nor larger than 4".

A previous advertisement in this series discussed tapping Transite Pressure Pipe for small service connections. A reprint is available on request. Address Johns-Manville, Box 290, New York 16, N. Y.

†The run of the fitting should have bell ends. Enlarged bells are used for class 150 pipe over 8" in diameter.

Conventional methods are used for making large service connections in Transite lines. Here are shown a tapping sleeve and valve being installed on a 12" line under pressure for a 4" outlet.

JOHNS-MANVILLE JM PRODUCTS

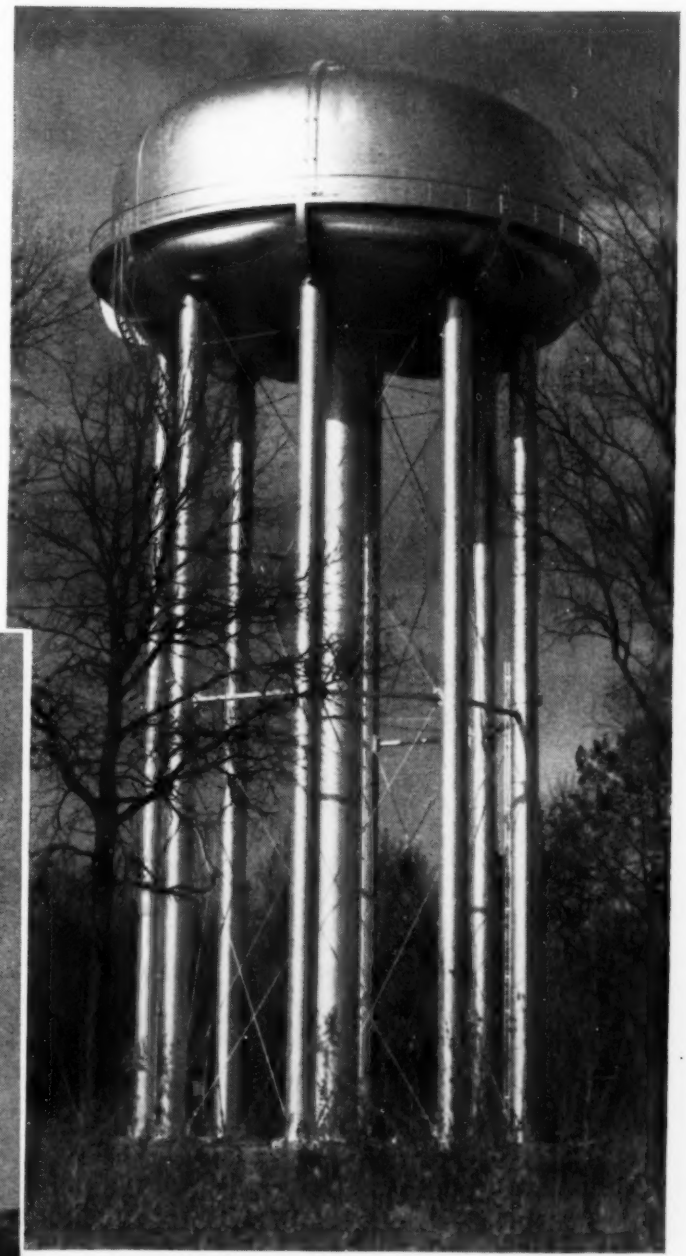
*Transite is a registered Johns-Manville Trade Mark

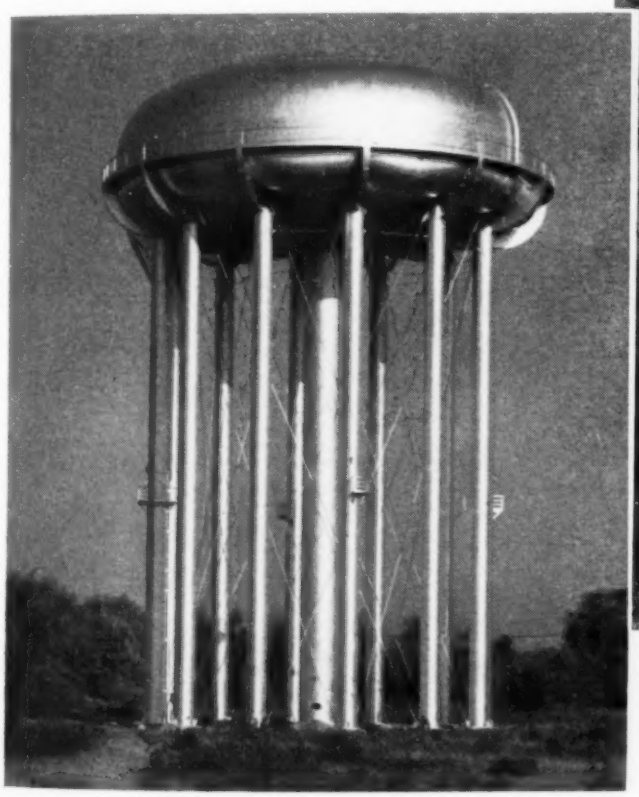
All the WATER that's needed . . . ANYTIME

WITH HORTON *ELEVATED* TANKS

Enough water in storage to meet the peak demands every day in the year . . . that's the concern of engineers who are designing modern water supply systems. One of the best answers to this problem is *distributed storage* . . . elevated water tanks strategically located to provide constant water pressure in heavy demand areas often remote from pumping stations.

Port Huron, Michigan, uses two Horton elevated tanks to provide distributed storage. A 1,000,000-gal. tank was erected at the southern limits of the city, and a 500,000-gal. tank at the northern limits. Some of the advantages expected from this installation are: adequate reserve in storage to meet afternoon peak loads; considerable savings in electric power costs at the pumping station; sufficient water pressure during periods when the pumping station is shut down.





Above: 500,000-gal. Horton elevated tank, 100 ft. to bottom in the northern portion of the Port Huron system.

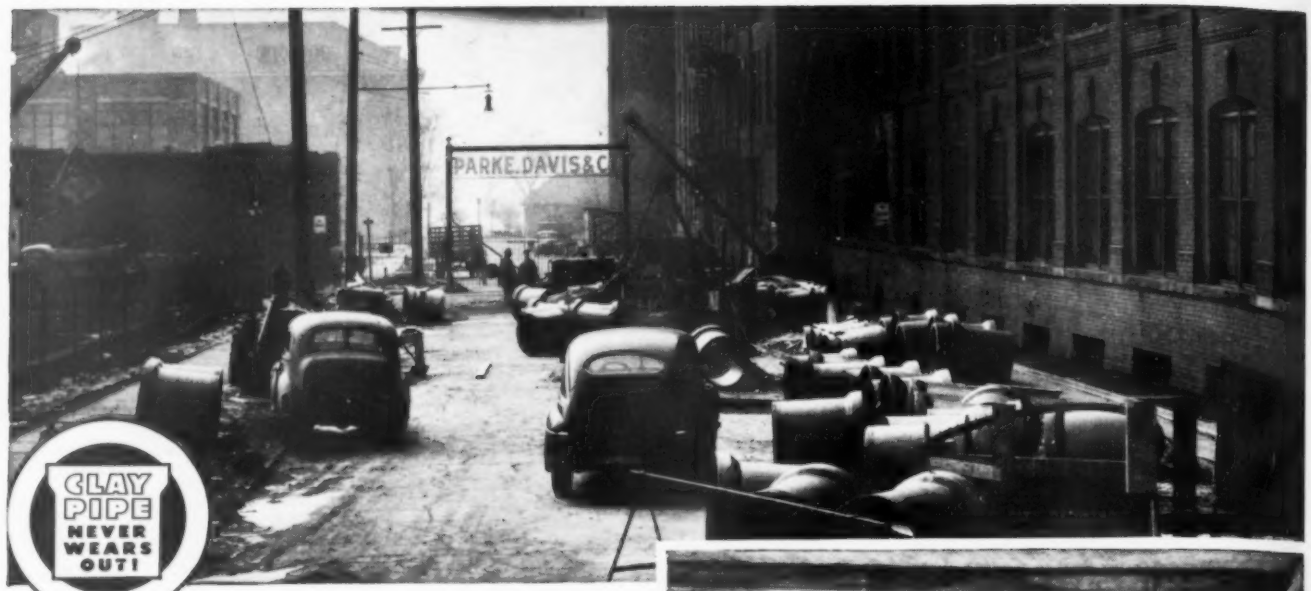
Left: 1,000,000-gal. Horton radial cone-bottom tank, 100 ft. to bottom in the southern portion of the Port Huron system.

Write for quotations on Horton elevated water tanks to meet your requirements.

CHICAGO BRIDGE & IRON COMPANY

Birmingham 1	1586 North Fiftieth Street	Cleveland 15	2262 Guildhall Bldg.	Philadelphia 3	1644-1700 Walnut Street Bldg.
Houston 2	2115 National Standard Bldg.	Los Angeles 14	1455 Wm. Fox Bldg.	Atlanta 3	2181 Healey Bldg.
Tulsa 3	1646 Hunt Bldg.	Chicago 4	2198 McCormick Bldg.	Havana	402 Abreu Bldg.
New York 6	3390—165 Broadway Bldg.	San Francisco 11	1283-22 Battery Street Bldg.	Detroit 26	1551 Lafayette Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA



VITRIFIED CLAY PIPE

Replaces Detroit Disintegrated Sewer

Municipal engineers are not crystal gazers—they can't look into the future and foresee what types of industry will spring up in their communities. In many cases, city engineers have found that sewerage and drainage lines, adequate when installed, could not withstand the deteriorating action of waste materials originating in the plants of new industries.

City of Detroit engineers were recently confronted with this problem of replacing worn-out sewerage lines. Vitrified Clay Pipe was specified because it is the only pipe able to withstand the damaging effects of waste matter originating in the lines of one of Detroit's principal industries. Clay Pipe's immunity to corrosion, rust and deterioration is the big reason more and more industrial, municipal and consulting engineers are making long-lasting Vitrified Clay Pipe a "must" in their specifications . . . for Clay Pipe resists successfully the action of chemicals, corrosive materials, alkalies, ground and sewage acids. Engineers know that

Tunneling was necessary on the Detroit municipal lines, using 27-inch and 30-inch Vitrified Clay Pipe. Ray D. Baker, contractor, handled the job with T. F. Forrest acting as construction superintendent. George R. Thompson was City Engineer.

there is not one single instance on record where Vitrified Clay Pipe has ever worn out!

If you need specific information on Clay Pipe, write the details to the office nearest you.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

1105 Huntington Bank Bldg., Columbus 15, Ohio
703 Ninth and Hill Bldg., Los Angeles 15, Calif.
522 First National Bank Bldg., Atlanta 3, Ga.
100 N. La Salle St., Rm. 2100, Chicago 2, Illinois

C-348-J

Vitrified CLAY PIPE

3 ADVANTAGES YOU GAIN

WHEN YOU SPECIFY B&A REAGENTS

Wider Selection Means you can order virtually all your reagent chemical requirements from the same source, at the same time. This is the economical way . . . the time-saving, easier way. More than 1,000 purity products of Reagent A. C. S., C. P., U. S. P., N. F., and Technical grades carry the B&A "Shield of Quality" label.

Highest Purity Means you're sure of getting reagents that always meet or exceed exacting *A. C. S. specifications* when you specify B&A. These purity standards set by the chemical profession itself are rigidly adhered to by Baker & Adamson, wherever established. That's why B&A Reagents have been recognized as "setting the pace in chemical purity" for sixty-six years.

Immediate Availability Means full stocks of B&A Reagents are carried at General Chemical's own chain of distributing Stations . . . conveniently located coast to coast to serve you promptly and efficiently. The Station nearest you can build its stocks to meet your special requirements readily at all times, if you will outline your anticipated needs to your B&A Salesman.

These Three Advantages Mean your chemical purchasing as well as laboratory operations can be made more efficient . . . more productive. Plan ahead now by writing or calling the nearest B&A office listed below.

Be sure to get the 200-page B&A Products Book . . . a valuable guide when buying reagents. Available on request.

REAGENTS
B&A
STANDARD OF PURITY
FINE CHEMICALS

BAKER & ADAMSON *Reagents*

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

Offices: Albany* • Atlanta • Baltimore • Birmingham* • Boston* • Bridgeport • Buffalo* • Charlotte* Chicago* • Cleveland* • Denver* • Detroit* • Houston • Kansas City • Los Angeles* • Minneapolis New York* • Philadelphia* • Pittsburgh* • Portland (Ore.) • Providence* • St. Louis* • San Francisco* Seattle • Wenatchee (Wash.) • Yakima (Wash.)
In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited • Montreal* • Toronto* • Vancouver*

* Complete stocks are carried here.

THE

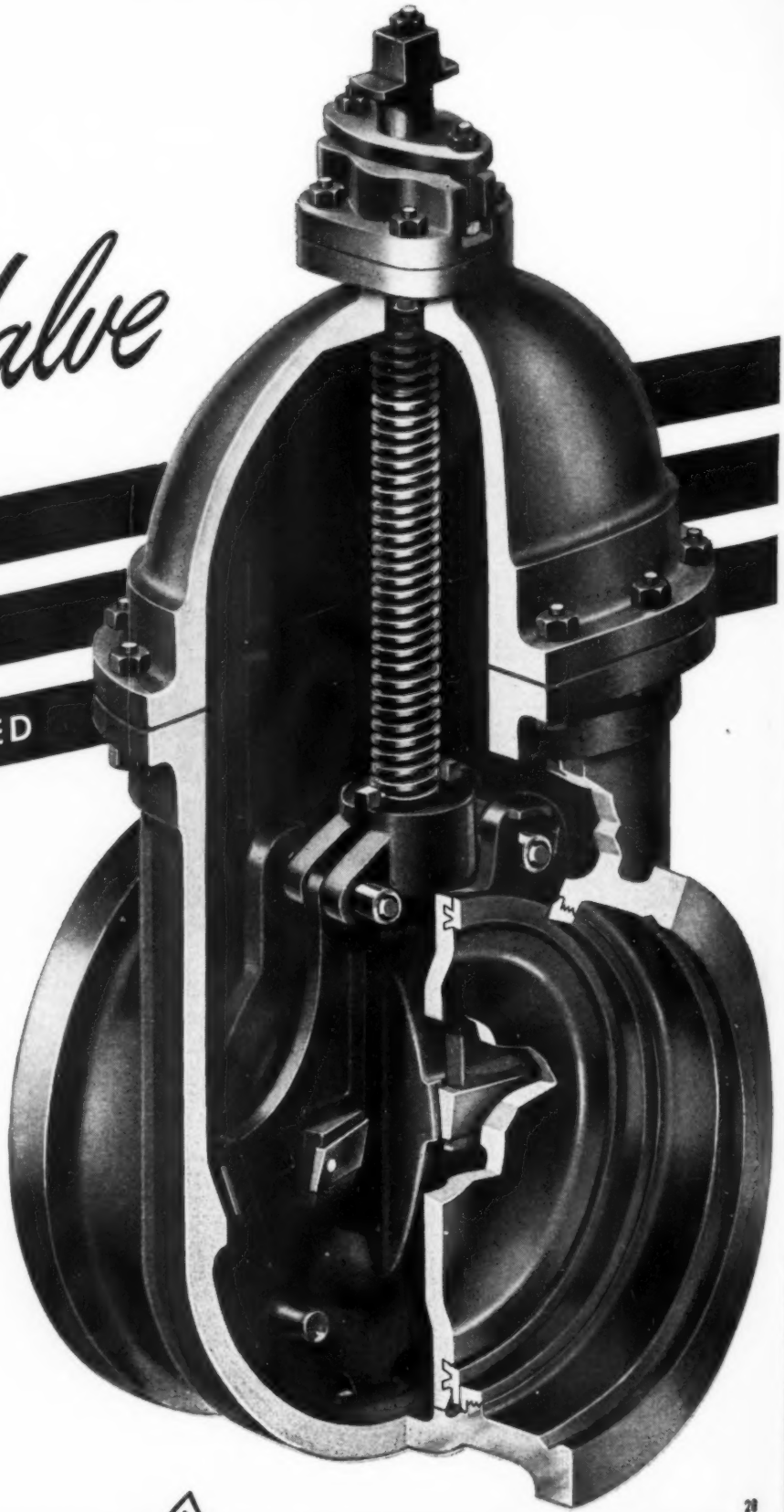
SMITH

Gate Valve

MANUAL,

ELECTRIC OR

CYLINDER OPERATED



The unique side wedging action employed in the Smith Gate Valve positively prevents premature lateral expansion of the discs and consequent binding and scoring of the seats while the valve is being operated.

20

GATE VALVES
CHECK VALVES
FIRE HYDRANTS
INSERTING VALVES
TAPPING SLEEVES AND VALVES
WATER SERVICE BRASS GOODS

THE A. P. SMITH MFG. CO.

ESTABLISHED 1896

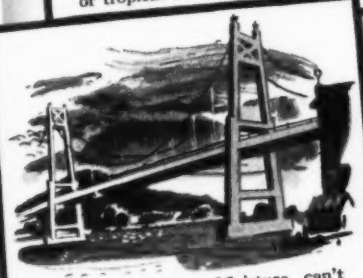
EAST ORANGE, NEW JERSEY

FLOOR STANDS
INDICATOR POSTS
TAPPING MACHINES
INSERTING MACHINES
PIPE CUTTING MACHINES
CORPORATION TAPPING MACHINES

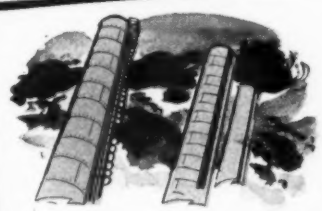
Stays Gleamingly New when other brands are weathered away!

VALDURA ASPHALT* ALUMINUM PAINT

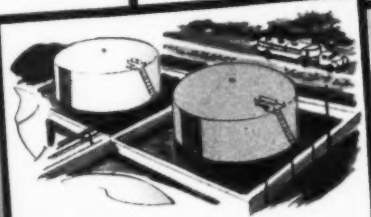
DEFIES WEATHERING — Won't crack under severe temperature changes or constant vibration. Withstands rain, snow, ice, salt . . . sub-zero weather or tropical heat.



DEFIES DAMPNESS — Moisture can't penetrate the asphalt and tung oil. 98% waterproof per coat! No chance of rust or corrosion.



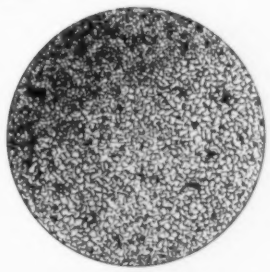
DEFIES SMOKE & FUMES — Smoke, fumes, soot, or brine can't harm Valdura Asphalt Aluminum Paint.



DEFIES ACTINIC RAYS — Destructive rays of the sun won't break down Valdura. Retains brilliant sheen year after year . . . gives maximum heat reflectivity.

VALDURA ASPHALT* ALUMINUM AFTER 4 YEARS, 4 MONTHS

Microscopic view of Valdura Asphalt Aluminum Paint film after being subjected to intense heat, low temperatures, wetting, drying and destructive rays of the sun. Condition perfect after this severe weathering!



ORDINARY ALUMINUM AFTER ONLY 4 MONTHS

This microscopic view of ordinary aluminum paint film shows badly worn, broken film after only 4 months identical exposure!

The Valdura film hasn't even started to break down after 12 times longer exposure!

***Exclusive blending of special processed Gilsonite Asphalt with Tung Oil is the SECRET!** This is the *one* and *only* aluminum paint that really endures — that stays silvery bright and shining year after year — *Valdura Asphalt** Aluminum Paint!

You can count on 5 to 10 years service — longer if 2 coats are applied. Only *Valdura* has a special Tung Oil vehicle plus a base of 99.5% pure Gilsonite asphalt — nature's most enduring weatherproofing substance. *Valdura* Asphalt Aluminum Paint is 98% waterproof per coat!

Valdura withstands steam, water, cold, heat, ice or brine. Resists all weathering. Used the world over on bridges, tanks, roofs, stacks, buildings. Outlasts, out-protects, out-wears all other aluminum paints in every comparison test! Costs no more, either! Write for full facts, *today!*

Valdura Division AMERICAN-MARIETTA COMPANY
Dept. 10, 43 E. Ohio St. — Chicago 11, Ill., U. S. A.

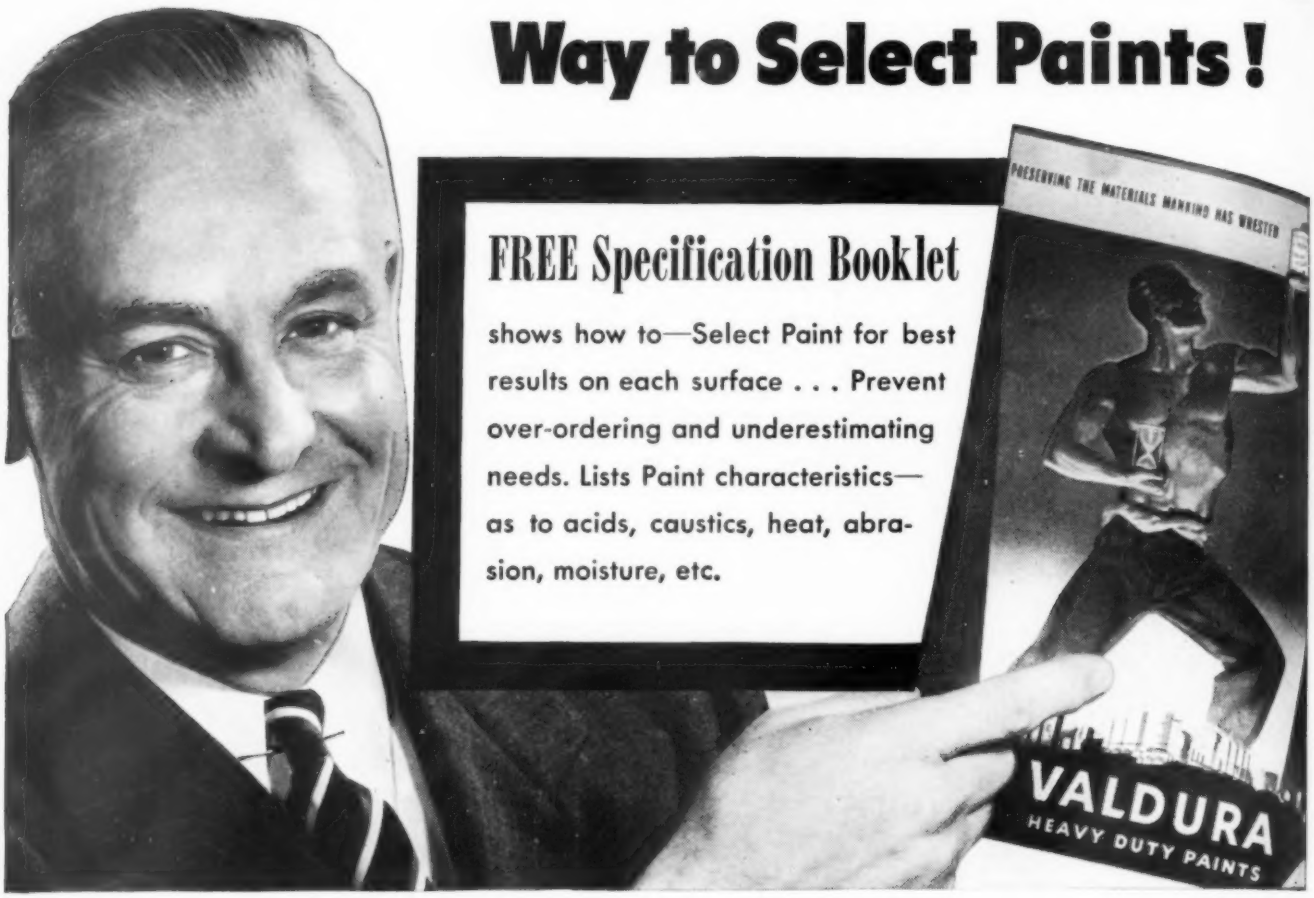
VALDURA PAINTS THAT ENDURE

ASPHALT ALUMINUM PAINT

Free Chart

See Next Page...

I Discovered This New Money Saving Way to Select Paints!


FREE Specification Booklet
shows how to—Select Paint for best results on each surface . . . Prevent over-ordering and underestimating needs. Lists Paint characteristics—as to acids, caustics, heat, abrasion, moisture, etc.
PRESERVING THE MATERIALS MANKIND HAS WRESTED
VALDURA
HEAVY DUTY PAINTS

It was a lucky day for me when I got the new Valdura Specification Booklet—on heavy-duty painting. I found it so practical, so easy to use, that it gave me valuable benefits when I selected the paints for renovating our plant.

As a result, we saved many dollars on the job. But best of all, we'll save many dollars every year on maintenance. This *Valdura Specification Booklet* shows the most serviceable paint to use for *every kind* of application in every industry.

Gives All the Answers—This amazing Valdura booklet lists every kind of surface that needs paint for maintenance. It shows just which kind of primers and finish coats give the best results for each surface. There's no chance of selecting the wrong paint. These recommendations are based on intensive research by Valdura's laboratories and on proved results of many thousands successful applications.

The Valdura Chart solved many other problems for me. It shows average coverage per gallon—so I knew exactly how much of each paint to order. It also shows the type and correct amount of thinner required for every paint. These were big factors in helping me save dollars on the job—and in getting the most value for the firm's money. The table showing product characteristics like moisture, abrasion, acid and caustic resistance, oil and heat was also a valuable help.

Can Save You Money—Yes, it was a lucky day for me and for my firm when I discovered the new Valdura Chart on heavy-duty painting. No wonder I say, "Send for your free copy of this amazing chart. It shows you how to save on paint jobs and cut maintenance costs. It helps you select paints that look better, last longer and improve working conditions!" Mail the coupon now!

Charts Now Ready For These 10 Industries

Bakeries
Breweries
Bottling Plants
Canning Plants
Dairies and Creameries
Institutions*
Laundries
Paper Mills
Power Plants
Sewage Disposal Plants

*Schools, Churches, Hotels, Colleges, Office Buildings—all public and private buildings.

Send For Your Free Copy

Valdura Division

AMERICAN-MARIETTA COMPANY

43 E. Ohio Street, Chicago 11, Illinois

"Paints that Endure"

Valdura Div., American-Marietta Co., 43 E. Ohio St., Chicago 11, Ill., Dept. O

Send me immediately the *free* Valdura Chart for my plant that will show me how to save real dollars—to select the correct paint, cut maintenance costs, improve working conditions.

Name and Title_____

Company_____ Industry_____

Address_____

City and Zone_____ State_____

HE DIDN'T MIND WHEN HIS BRIDE BURNED THE BISCUITS

BUT...HE PHONED CITY HALL WHEN THE WATER TASTED BAD!

DISTASTEFUL water is an invitation to customer complaints. In more than 1200 communities, Aqua Nuchar Activated Carbon has been used to eliminate complaints on tastes and odors. Aqua Nuchar acts simply, quickly and effectively to rid water supplies of those impurities causing bad tastes and odors. Owing to its extraordinary porosity, Aqua Nuchar traps those tiny substances that cause unpalatable water.

It costs so little . . . and, whether they're aware of it or not, it means so much to consumers. Eliminate complaints . . . quickly, inexpensively and thoroughly . . . with Aqua Nuchar Activated Carbon.

Stocks located at points throughout the country for immediate delivery.

INSURES PALATABLE AQUA NUCHAR AQUA DRINKING WATER

industrial CHEMICAL SALES

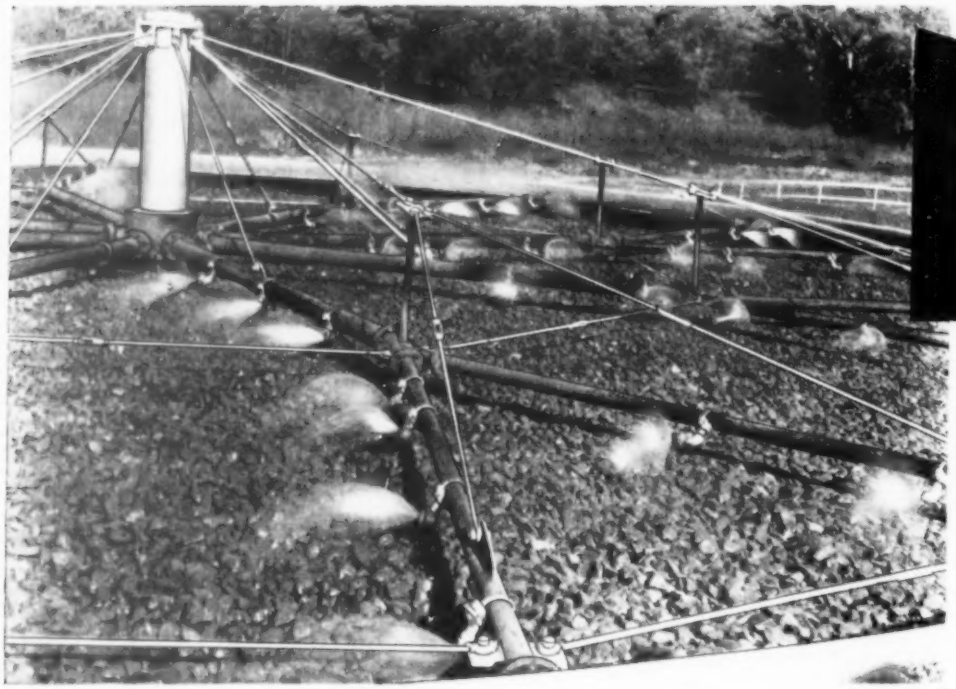
division west virginia pulp and paper company

NEW YORK CENTRAL BLDG.
230 PARK AVENUE
NEW YORK 17, N. Y.

PURE OIL BLDG.
35 E. WACKER DRIVE
CHICAGO 1, ILLINOIS

PUBLIC LEDGER BLDG.
INDEPENDENCE SQUARE
PHILADELPHIA 6, PA.

LEADER BLDG.
526 SUPERIOR AVE., N.W.
CLEVELAND 14, OHIO



HIGH

IN PURIFYING EFFICIENCY

LOW

IN COST

YEOMANS

"Aero-Filter"

SYSTEM

for sewage and waste treatment

In more than 100 installations the Yeomans "Aero-Filter," a high capacity biological trickling filter, is establishing remarkable records for an unusually high degree of purification at exceptionally low cost.

Note these seven important advantages:

1. Rain-drop distribution is highly efficient, which eliminates all need for costly recirculation for dilution purposes.
2. Single-stage operation produces a clear effluent; and reductions of raw sewage BOD ranging from 80% to 85% are common.
3. Two-stage operation is regularly obtaining reductions of raw sewage BOD ranging from 90% to 94%.
4. Construction cost is remarkably low, since the Aero-Filter bed is about one-eighth the size of a standard rate filter bed for equal capacities.
5. Operating cost is the lowest of all types of complete sewage treatment—no additional pumps, motors, tanks, etc., for recirculation.
6. Uninterrupted and almost complete momentary bed coverage minimizes troubles from odors, freezing, ponding and filter flies.
7. All returns are made direct to the filter—therefore an oversize primary tank to accommodate recirculation is unnecessary.

The "Aero-Filter" can be fitted to any requirements, from small units up to large treatment works. Accurate cost estimates and complete engineering data are readily obtainable—simply write us.

For treating industrial waste, the Aero-Filter has proved ideal—

High Loading—especially important in treating exceedingly strong waste.

Economy of Space—the filtration bed is much smaller than in other types of treatment plant.

Low Cost—economical to install, costs much less to operate—owing largely to absence of recirculation for dilution.

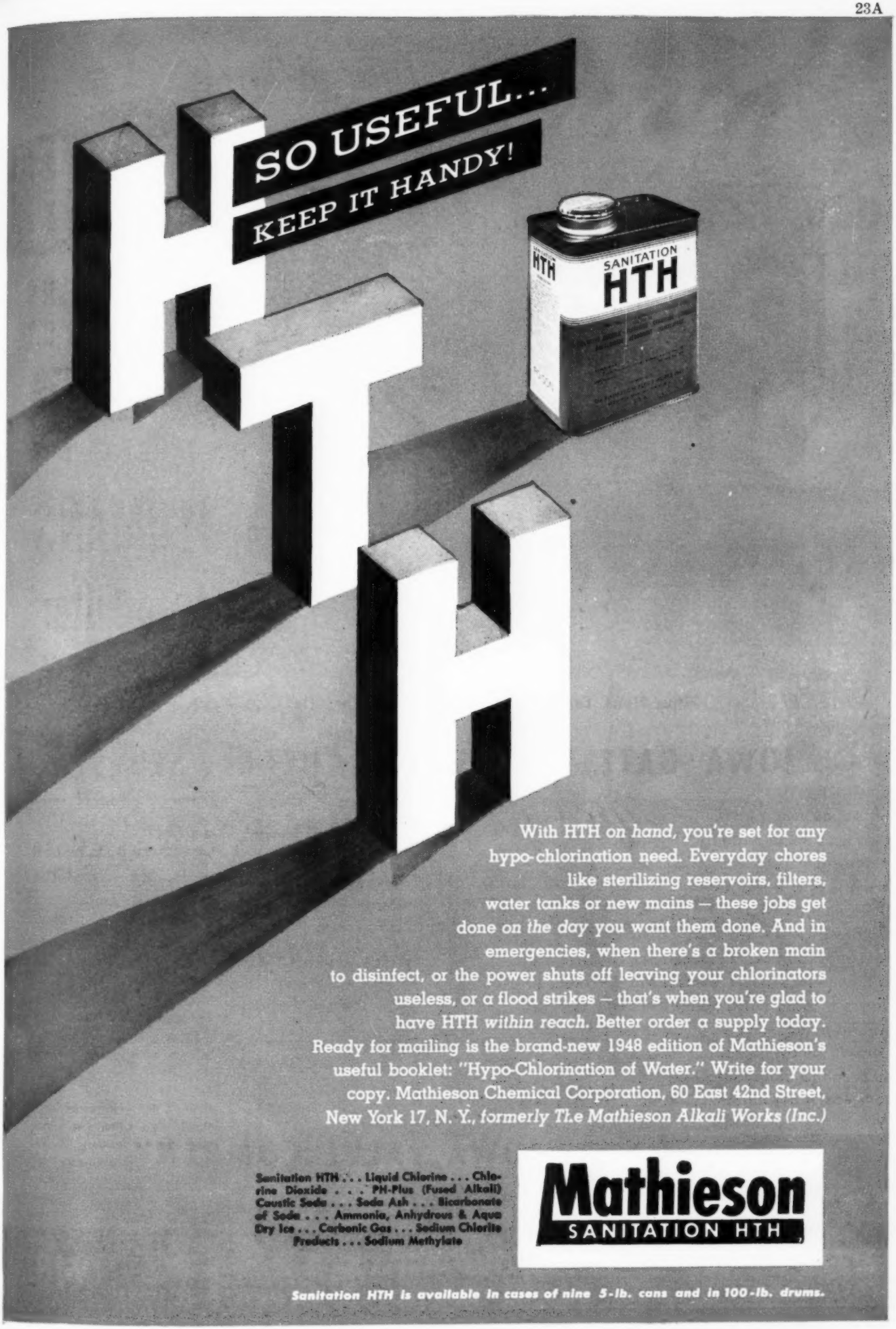
YEOMANS BROTHERS COMPANY

1423 NORTH DAYTON ST.
CHICAGO 22, ILLINOIS

For the handling and treatment of domestic sewage and industrial waste, Yeomans manufactures: Yeomans Aero-Filter—high capacity trickling filter ● Yeomans "Package" Aerifier—activated sludge process ● Rectangular and circular Sludge Collectors ● Digesters ● Centrifugal and pneumatic Sewage Ejectors ● Scum, Grease and Sludge pneumatic Ejectors ● Rotary Distributors ● Plunger Sludge Pumps.

1898 **YEOMANS** 1948

50 YEARS OF PUMP EXPERIENCE

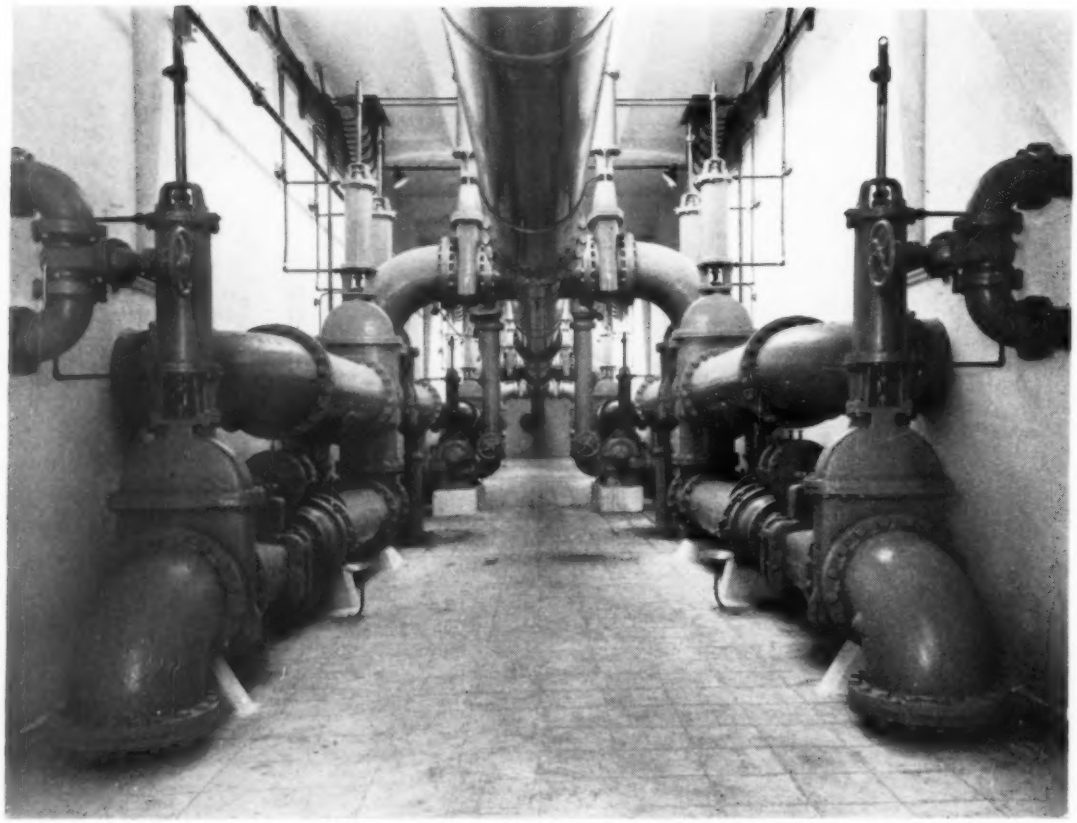


With HTH *on hand*, you're set for any hypo-chlorination need. Everyday chores like sterilizing reservoirs, filters, water tanks or new mains — these jobs get done *on the day* you want them done. And in emergencies, when there's a broken main to disinfect, or the power shuts off leaving your chlorinators useless, or a flood strikes — that's when you're glad to have HTH *within reach*. Better order a supply today. Ready for mailing is the brand-new 1948 edition of Mathieson's useful booklet: "Hypo-Chlorination of Water." Write for your copy. Mathieson Chemical Corporation, 60 East 42nd Street, New York 17, N. Y., *formerly The Mathieson Alkali Works (Inc.)*

Sanitation HTH . . . Liquid Chlorine . . . Chlorine Dioxide . . . PH-Plus (Fused Alkali) Caustic Soda . . . Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua Dry Ice . . . Carbonic Gas . . . Sodium Chlorite Products . . . Sodium Methylate

Mathieson
SANITATION HTH

Sanitation HTH is available in cases of nine 5-lb. cans and in 100-lb. drums.



Filter Plant, East Bay Municipal Utility Dist., Oakland, Calif.

IOWA GATE VALVES and CHECK VALVES

Specified for This Installation

Briefly, here is why you find "Iowa Valves" specified by Water Works Engineers, Superintendents and Operators of Water Treatment Plants, Pumping Stations and Distribution Systems, time after time after time: —

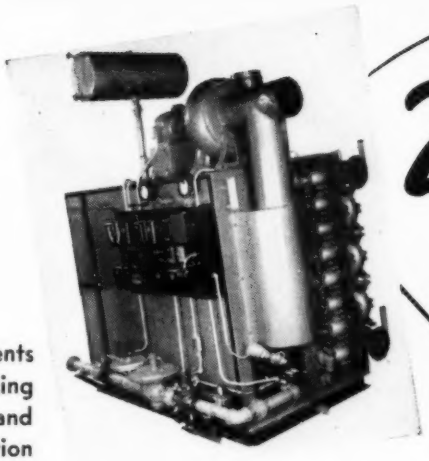
- **Recognized Design**
- **Quality of Materials**
- **Quality of Workmanship**
- **Prompt, Dependable Delivery**
- **35 Year history of satisfactory performance**

You are invited to fully acquaint yourself with current Iowa Valve developments and qualities. Write for completely illustrated, descriptive literature.

IOWA VALVE COMPANY

(Subsidiary of James B. Clow & Sons)

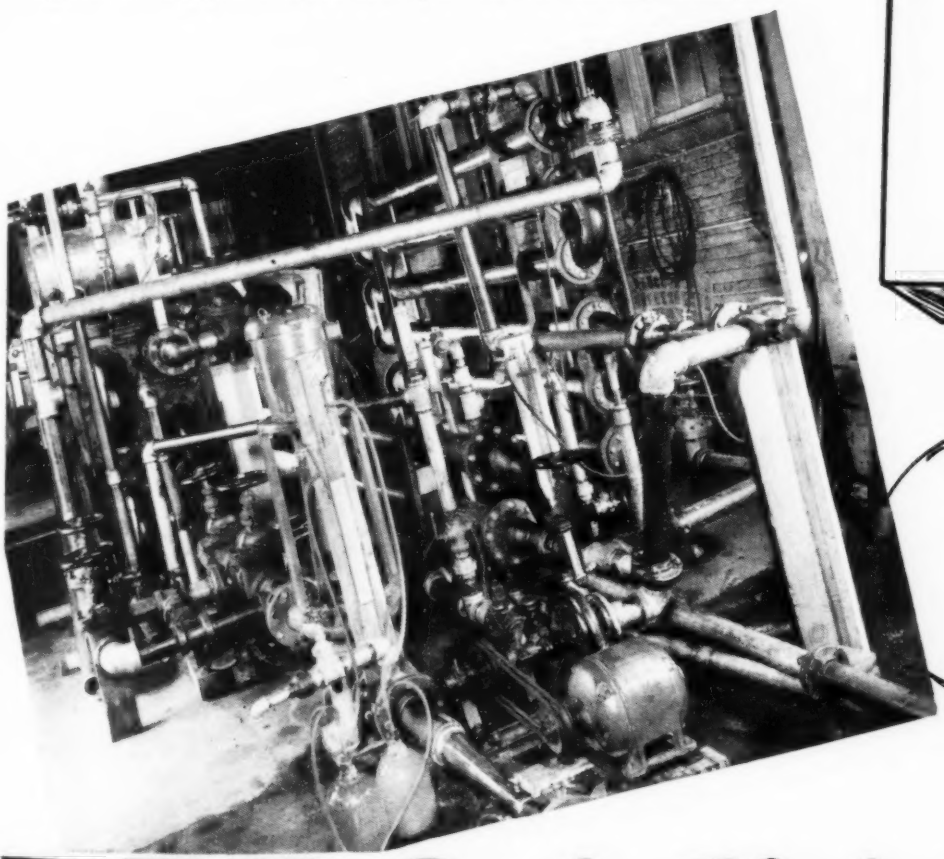
201-299 North Talman Avenue P. O. Box 6600A Chicago 80 Illinois



One of two No. 750 Heater and Heat Exchanger Units for Lamberts Point Plant, Norfolk, Virginia. Aldrich and Buck, New York, N. Y., Engineers.

WHO SHOULD BE THE GUINEA PIG ON NEW EQUIPMENT?

One year of extensive experiments in external heating BEFORE placing a single new Digester Heater and Heat Exchanger unit in operation —that's the Pacific Flush-Tank Company's answer to the question. In its customary role of "guinea pig," P.F.T. kept the experimental layout shown below in operation 5 and 6 days a week during 1944 and 1945 to determine heat transfer and loss of head. To gather reliable and empirical data on sludges to be encountered, different types of sludges were brought in from representative sewage treatment plants and used in the test work. The result: more than 55 completely successful installations already. Another 55 are on order and in process of fabrication. The unit above is arranged for automatic gas and oil firing, automatic digester temperature maintenance, automatic building heating, and has complete flame safety protection. Normal output: 750,000 B.t.u. per hour for digester heating plus 375,000 B.t.u. per hour for building heating.



P.F.T *Pacific Flush-Tank Co.*

4241 RAVENSWOOD AVENUE, CHICAGO

NEW YORK CHARLOTTE, N.C.

SEWAGE TREATMENT EQUIPMENT EXCLUSIVELY SINCE 1893

LOS ANGELES — SAN FRANCISCO — TORONTO

R-S valvEvents

ISSUED PERIODICALLY BY R-S PRODUCTS CORPORATION, PHILADELPHIA 44, PA., FOR THOSE CONCERNED WITH FLOW CONTROL AND SHUT-OFF

R-S Duplex Strainer Assures Clean Water

Utilities and industrial plants which must have clean water are showing keen interest in the new R-S Duplex Strainer because of its simple control features.

Single handwheel control by only 2½ turns permits alternate removal of identical basket strainers without interruption to flow. This is the feature which gives the R-S Duplex Strainer its striking advantage over the old-style 2-wheel control involving complete shut-off or flow during the cleaning operation.

R-S Duplex Strainer (Patent Pending)

Illustration shows that the valve is in continuous contact with the seat so that it cannot become fouled or loose. Further, the valve mechanism is on the downstream side, in contact with strained water only, not in the path of flow, and therefore less subject to erosion or wear. There is but one stuffing-box.

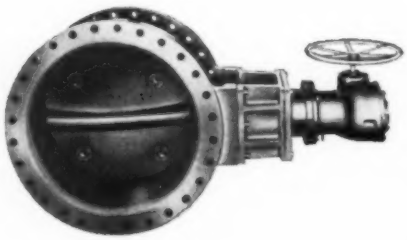
Four-inch to 24-inch pipe-sizes are available. Pressure loss is extremely low. The ratio of straining area in each compartment to the area of the inlet is approximately 3 to 1.

Descriptive material including tables, graphs, and drawings will be sent on request to R-S Products Corporation—Valve Division—Wayne Junction, Philadelphia 44, Pennsylvania.

New R-S Representative in Mexico

The R-S Valve Division announces appointment of a new representative covering all of Mexico. This is Equipos Hidraulicos de Mexico, S. A. Address: Edificio "Atlan", Avenue Juarez 76, Mexico, D. F.

NEW R-S 50-POUND CLASS B IRON VALVE



This new valve, R-S type B-9468, designed for rugged hydraulic service, is equipped with the R-S rubber spool (Type B-8934). Patent Pending.

The rubber spool combined with the wedge-type closure of the R-S angular seating disc provides positive shut-off for thousands of full-open to full-closed cycles. Despite its conservative rating as a 50-pound valve the new unit will give bubble-tight shut-off up to 80 p.s.i. air, and commercially tight shut-off at 100 p.s.i. water.

No Better Ad Than A Satisfied Customer!

Fischer & Porter Company of Hatboro, Pa., manufacturers of Indicating, Recording, Controlling, and Totalizing Flowrator instruments for flow-rate measurement and automatic flow control, recently wrote the R-S Philadelphia representative:

"You will be gratified to learn of the excellent success the R-S Butterfly Valves, supplied by you for our stock flow measurement control, have enjoyed.

"Our Canadian Field Engineer writes as follows on the R-S Valve:
'. . . it has proved a complete success in this service . . . this R-S control valve has created great interest in the Canadian trade. On a recent bleachery application, it was pointed out that had butterfly type valves been employed a saving of approximately half in valve costs could have been effected'."

William Diament
Vice President-in-charge-of-Sales

Proper Sizing Essential to Success of Regulating Valve

When installing the disc or butterfly type of valve, as developed by R-S Products Valve Division, it is important for best results that the greater capacity—2 to 3 times that of many conventional valves of the same size—be recognized. In regulating service a 6-inch R-S valve will often replace a 10-inch valve of other types. Naturally, with the smaller R-S valve, there is less metal to pay for, less machining to be done, and less load to support in the line. These advantages represent great savings in cost, especially when hard or high cost metals are specified to counteract unusual abrasive or corrosive conditions.

R-S to Display at Instrument Show

R-S Valves and valve controls, both manual and automatic, will be on view at the Third National Instrument Exhibit in Philadelphia, September 13 to 17. The new R-S Leveltronic Relay will also be an interesting feature of the exhibit.

The rapid growth of the Instrument Show is a revealing index of the rising interest in Instrumentation as a science. It is a reflection, too, of industry's need to answer mounting labor costs by instrument control wherever hand labor can be replaced by automatic control.

The new R-S Leveltronic Relay will be of notable interest to instrumentation engineers because of its astonishing potentialities for control purposes. For example, the relay provides direct or reverse action giving fail-safe control of line failure and preventing overflow or underfilling of process units. Out-contacts sound an alarm, light a light, or shut the process down.

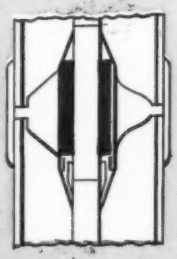
The New R-S Valve Catalog #17

R-S Valve Catalog #17 is packed with information for engineers. There are over 70 halftone pictures of R-S Valves . . . working drawings of 21 types of R-S Valves with standard controls and fittings and complete dimensional data for all sizes . . . working drawings of 22 types of prime movers . . . numerous other diagrams, graphs and miscellaneous drawings. Address R-S Products Corporation, Valve Division, Philadelphia 44, Pa.

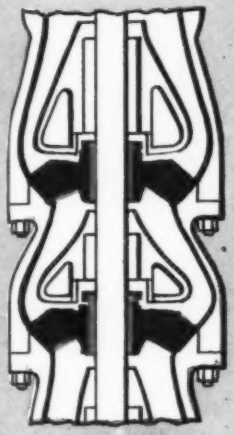
JMLco P-GG2

EASY ADJUSTABILITY. With one simple "at the surface" adjustment, you can vary capacities over a wide range without power-wasting "throttling." Adjustment nut can also be used to compensate for wear . . . assuring new pump efficiency *for the lifetime of the pump!*

IT isn't just chance that Pomona gives you all the features you've always wanted in a vertical turbine pump. Lowest-cost-per-gallon service . . . unequalled dependability . . . simplicity of installation and maintenance, these are "designed-in" features resulting from years of experience. Just check these features. You'll find what you want!



QUIET, SMOOTH OPERATION. Pomona's revolvable rubber shaft bearings assure vibration-free shaft support under all conditions.



WANT

GET

POMONA!

FREEDOM FROM SAND-LOCKING. You won't have any costly stoppages with Pomona. Open impeller design assures complete freedom from sand-locking . . . minimizes wear . . . eliminates the need for sealing or wearing rings.

WATER LUBRICATION. Pomona's *true* water lubrication is your guarantee of clean, clear water. Water lubrication also means simplicity of design with fewer working parts for maximum dependability, lower operating costs, less maintenance.

CHECK THESE and other "wanted" Pomona features with your Fairbanks-Morse Pomona dealer or branch pump engineer. They can show you how the Pomona line . . . sizes from 4 to 36 inches, capacities from 15 to 20,000 G.P.M. . . . gives you more!

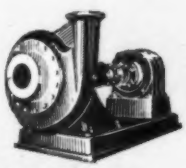
Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE

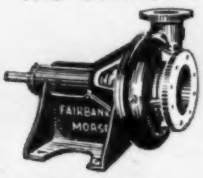
A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS

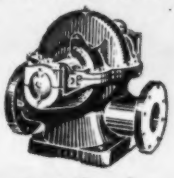
A FEW OF THE COMPLETE LINE OF FAIRBANKS-MORSE PUMPS



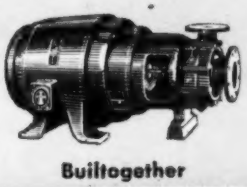
Trash Pumps



Side-Suction



Centrifugals



Builtogether

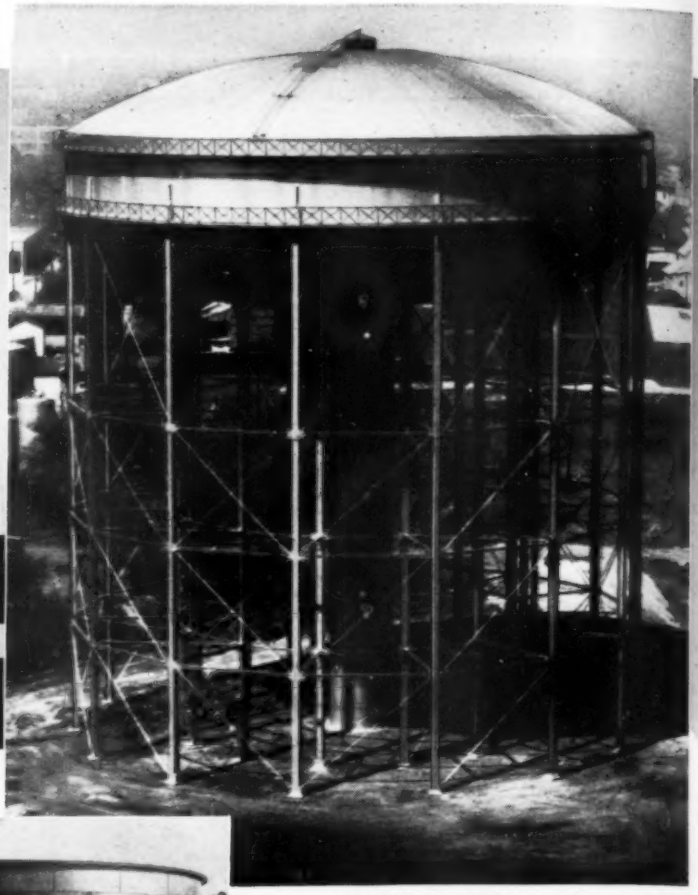
Long-Term Assets to the Modern Waterworks System . . . . .

***for* EFFICIENT SERVICE · LOWER MAINTENANCE · GREATER DURABILITY**

Pittsburgh · Des Moines

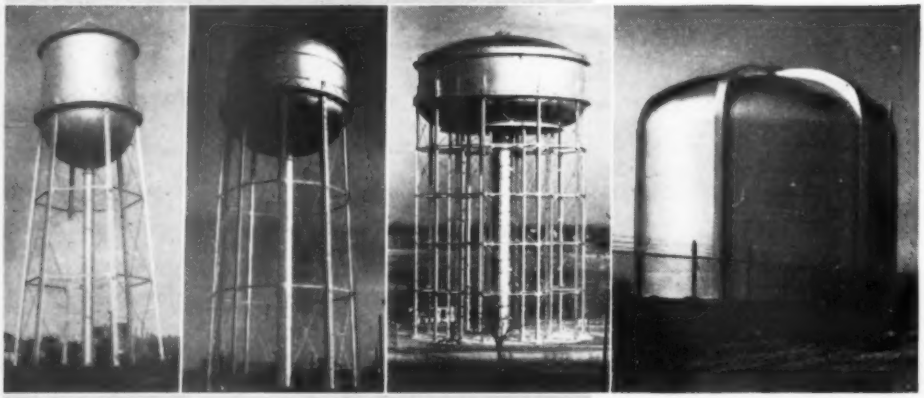
ELEVATED STEEL TANKS

and STEEL RESERVOIRS



1,500,000 gal. toroidal bottom tank; structural tower. Diameter 103'4", head range 25', height to bottom 85'. Fort Dodge, Iowa.

Two 3,000,000 gal. steel reservoirs, diameter 144', height 25'. Berryville, Va.



300,000 gal. cone roof, hemispherical bottom tank, 118' to top. Stillwater, Okla.

500,000 gal. double ellipsoidal tank, on 100' tower. Mission, Texas.

1,000,000 gal. toroidal bottom tank; diameter 76'9" height 127', head range 30'. Keokuk, Iowa.

2,200,000 gal. steel reservoir; ellipsoidal roof; ornamental pilasters. Diameter 80', height 51'. Midland, Tex.

The choice of elevated steel tank or steel reservoir depends largely upon local land elevations. The choice of PITTSBURGH-DES MOINES as designers, fabricators and erectors of your required units is equally logical: you benefit by a half-century of experience in this type of construction, and a guarantee of complete satisfaction with each installation. *May we consult on your water storage needs?*

A NEW PITTSBURGH · DES MOINES STEEL FABRICATING PLANT at SANTA CLARA, CALIFORNIA

PITTSBURGH · DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

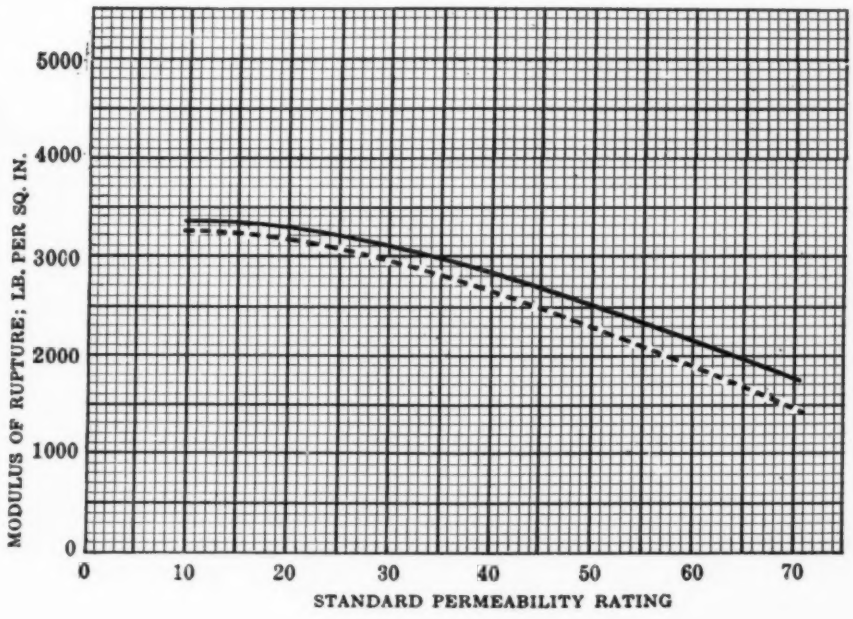
PITTSBURGH.....3418 Neville Island
NEW YORK.....Room 918, 270 Broadway
CHICAGO.....1222 First National Bank Building
DES MOINES.....919 Tuttle Street
DALLAS.....1223 Praetorian Building
SEATTLE.....526 First Avenue, South
SANTA CLARA, CAL.....625 Alviso Road

Making Sewage Aeration More Effective with ALOXITE Diffusers

RELATION OF STRENGTH TO PERMEABILITY

——— Dry

– – – Saturated



Dependable Trouble Free Service Assured

ALOXITE aluminum oxide porous plates and tubes are rugged and durable. This is exemplified in the chart giving their high modulus of rupture for various permeability rating. It is confirmed by experience in over 225 plants. ALOXITE diffusers last longer, require less maintenance and far less frequent replacement. Some operators even report that cleaning is still unnecessary after more than ten years service.

ALOXITE diffusers stand up under repeated handling. They resist chemicals, acids and other corrosive materials. They can be quickly and thoroughly cleaned by chemicals, chlorination, acid treatment, burning, etc.

The more effective treatment made possible by ALOXITE plates and tubes is also more economical. Maintenance and replacement costs are negligible. Further savings are realized in the lower operating and maintenance requirements of blowers and other equipment.

In brief, these are a few facts that have led to the installation of these modern air diffusers in many plants. We will be glad to furnish further details. Our technical staff will be glad to discuss problems peculiar to your operating set-up. Merely write Department M-78, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

DIFFUSER MEDIA

UNIFORM STRUCTURE
CORROSION RESISTANT
RUGGED AND DURABLE
ECONOMICAL
EASY TO CLEAN
LOW PRESSURE LOSS

BY **CARBORUNDUM**
TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Here's what city "A" wrote to city "B" about Badger Meters

"We have approximately 24,000 meters, of practically all standard makes. Exhaustive tests as to accuracy, maintenance cost and durability have shown the Badger Meter has given most satisfactory service. For the last three years we have purchased only Badger Meters."

There's a Badger Meter size and type for every waterworks service. Performance records by the millions prove "It pays to BUY BADGER."

BADGER METER MFG. CO., MILWAUKEE 10, WIS.

Every waterworks superintendent should have a copy of our new chart: "Table for Determining Service-Pipe and Meter Sizes", No. 676 (no charge).

BADGER Water METERS

ACCURACY · LOW COST MAINTENANCE · DURABILITY · SENSITIVENESS

BRANCH OFFICES:

NEW YORK CITY • PHILADELPHIA • WORCESTER, MASS.
SAVANNAH, GA. • CINCINNATI • CHICAGO • KANSAS CITY, MO.
WACO, TEX. • SALT LAKE CITY, UTAH • PORTLAND, ORE. • SEATTLE, WASH. • LOS ANGELES

NEW ELECTRONIC UNIT IMPROVES, SIMPLIFIES WATER CLARIFICATION

FOR MUNICIPAL OR INDUSTRIAL PLANTS

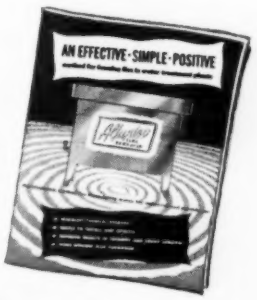
Using only low voltage electricity and aluminum to form concentrated aluminum hydroxide floc, the Alhydro Floc Producer provides a simple and effective answer to the problem of removing color and suspended matter from water . . . without the need for handling or storing large quantities of chemicals!

Since a single unit occupies much less space than an ordinary office desk, the Alhydro Floc Producer can be readily installed in existing or proposed water plants. Simple adjustment of rectifier for volume of low voltage direct current is the only control required for day-to-day operation.

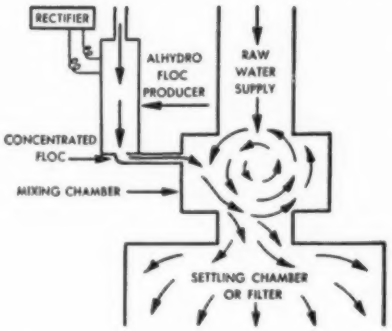
Alhydro FLOC PRODUCER
PATENTS PENDING

DESCRIPTIVE FOLDER--FREE!

If properly treated water is essential to the quality of your product, write today for this free folder explaining and illustrating the compact new Alhydro Floc Producer. See for yourself how the Alhydro Floc Producer greatly simplifies the treatment of drinking water or water for industrial use.



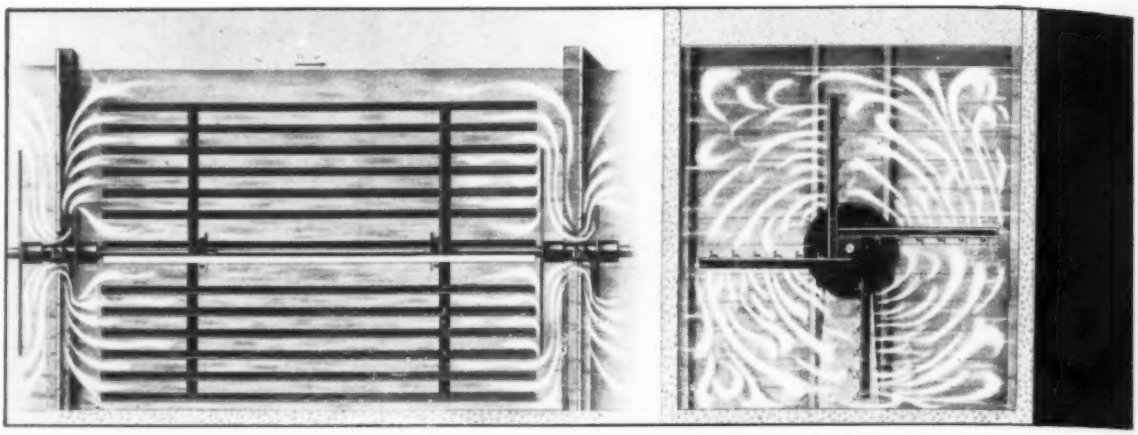
This installation of the Alhydro Floc Producer in your water treatment plant will provide you with . . .



- **Superior results in color and turbidity removal.**
- **Better water at competitive cost.**
- **Simplicity of operation.**
- **Ease of maintenance.**
- **Elimination of storage problems.**
- **Instantly controlled floc volume.**

ALHYDRO, INC. DEPARTMENT 7B
516 N. CHARLES ST., BALTIMORE 1, MD.

for Efficient Mixing...



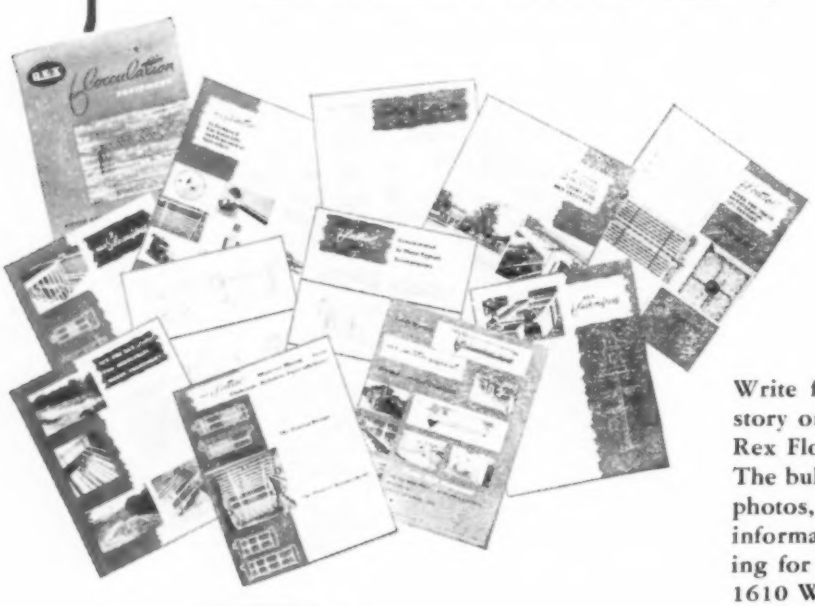
REX *floctrol*

Here are improved, thorough mixing, savings on chemicals, and increased plant efficiency —with Rex Floctrol.* What's more, the extreme flexibility of Floctrol fits a wide range of operating conditions.

Based on the principle of tapered mixing, Rex Floctrol assures an optimum floc with a minimum amount of chemical. The paddle axis is parallel to the line of flow, giving uniform treatment to all flow and eliminating short-circuiting. In the Floctrol tank, all flow is directed into active mixing area, causing complete utilization of full tank volume and thorough dispersion.

The Floctrol principle can be applied to existing tanks. Installation is simple and initial cost is low. Savings in power, time, and chemicals make it worth your time to investigate Rex Floctrol.

*Reg. U. S. Pat. Off.



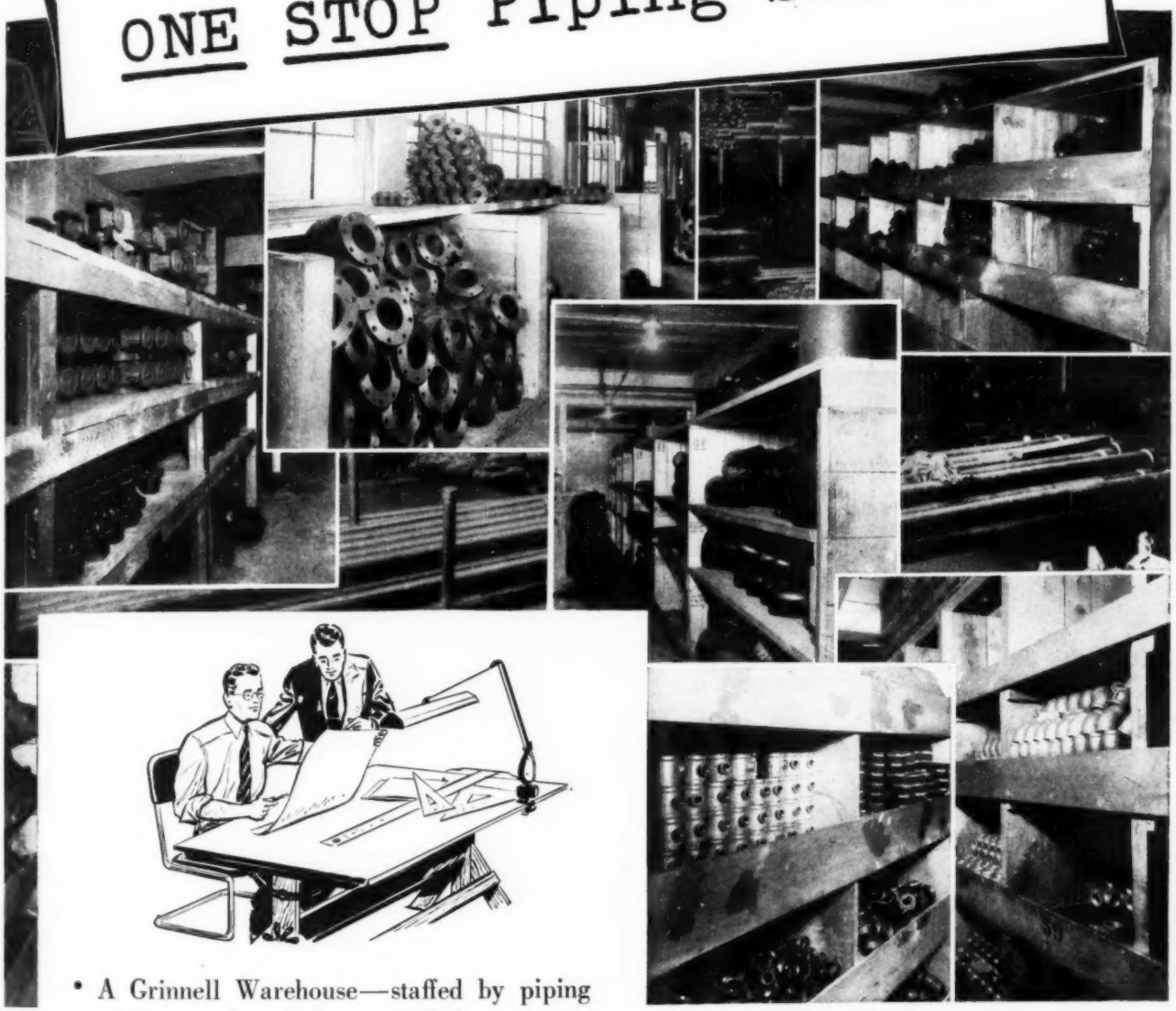
here's the Story on better flocculation

Write for Bulletin 48-39. It contains the complete story on how to increase your mixing efficiency with Rex Floctrol, Rex Slo-Mixers, and Rex Flash-Mixers. The bulletin contains engineering details, installation photos, diagrams of typical installations, and valuable information you'll want to help you get the best mixing for the least cost. Address Chain Belt Company, 1610 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT COMPANY — REX — WATER TREATMENT EQUIPMENT

Member of the Water and Sewage Works Manufacturers Association, Inc.

ONE STOP Piping Service



• A Grinnell Warehouse—staffed by piping specialists ready to help you with the engineering on your piping layouts, and carrying "everything for piping"—can be a time and money saving One-Stop supplier for you. Take advantage of this *complete* piping service.

GRINNELL COMPANY, INC., Providence 1, R. I.

GRINNELL

FOUNDED 1850

WHENEVER PIPING IS INVOLVED

Branch Warehouses

Atlanta 2, Ga.	Kansas City 16, Mo.	Philadelphia 34, Pa.
Charlotte 1, N. C.	Long Beach 10, Cal.	Sacramento 14, Cal.
Chicago 9, Ill.	Los Angeles 13, Cal.	St. Louis 10, Mo.
Cleveland 14, O.	Milwaukee 3, Wis.	St. Paul, Minn.
Cranston 7, R. I.	Minneapolis 15, Minn.	San Francisco 7, Cal.
Fresno 1, Cal.	New York 17, N. Y.	Seattle 1, Wash.
Houston 1, Tex.	Oakland 7, Cal.	Spokane 15, Wash.

PIPING SUPPLIES

- Pipe, Valves and Fittings
- Engineered Pipe Hangers
- Grinnell-Saunders Diaphragm Valves
- Thermolier Unit Heaters
- Prefabricated Piping
- Plumbing and Heating Specialties
- Oil, Water Works and Industrial Piping Supplies

OTHER GRINNELL PRODUCTS

Automatic Sprinklers and Special Hazard Fire Protection Systems

AMCO Humidification and Cooling Systems

In BOTH water supply and sewage Beckman pH control

Cuts treating costs... Saves chemicals... Increases efficiency

...IN WATER SUPPLY

In the main treating plant of the giant Metropolitan Water District of Southern California—a system capable of delivering a BILLION gallons of water per day across the entire state of California, and one of the largest water treating jobs in the world—the pH control equipment is 100% BECKMAN! In the mammoth treating plant where the water is softened and purified, Beckman Automatic pH Instruments control the pH of the liming process... of the carbonation process... and the pH of the final treated water. This 100% installation is notable tribute to the dependability of Beckman Equipment!

...IN SEWAGE TREATMENT

At its Stickney installation—world's largest sewage plant—the Sanitary District of Chicago tried Beckman pH Control on the chemical end of its sewage treating operations ...found that it not only saved time and chemicals, but increased plant efficiency and decreased operating costs so successfully that a second installation was ordered for its Calumet Plant to cut operating costs there. Recently it ordered a THIRD Beckman pH Installation for still another plant in its large municipal system. Clear-cut evidence like that tells its own story!

LARGE OR SMALL, *YOUR* PLANT CAN SAVE WITH BECKMAN pH CONTROL!

The Beckman Automatic pH Indicator—Continuously and automatically *indicates* pH, and operates standard *recording* and *control* equipment for fully automatic pH control. Ask for Bulletin 161

The Beckman Industrial pH Meter—Ideal for portable plant and field use. Simple, rugged, accurate, and incorporates many unique operating features. Write for Bulletin 211

FREE! WHAT *EVERY* EXECUTIVE SHOULD KNOW ABOUT pH... simplifies the technicalities of modern pH control. Tells what is it, how it's used, where it fits into modern treating operations. Send for your free copy today!

Name_____

Position_____

Address_____

City_____ State_____

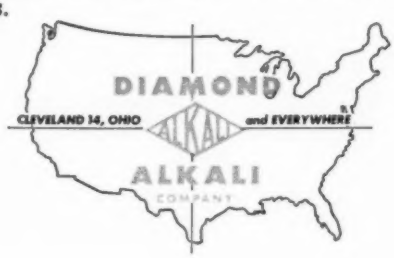
NATIONAL TECHNICAL LABORATORIES
SOUTH PASADENA 21, CALIFORNIA

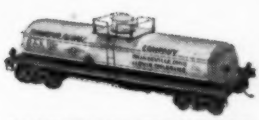
Beckman THE LEADING NAME IN pH

DIAMOND *Liquid* CHLORINE

will definitely help make this possible

Yes, pleasure boating, fishing, swimming and other recreational activities are a definite possibility—in nearby rivers and streams of pure, fresh water—as plans for the elimination of stream pollution progress. Diamond Liquid Chlorine is helping to make the over-all program possible, through the chlorination of domestic sewage and industrial wastes in disposal plants now being installed by communities and industries.





SUPPLIED IN TANK CARS

MULTI-UNIT CARS

OR CYLINDERS

everywhere...

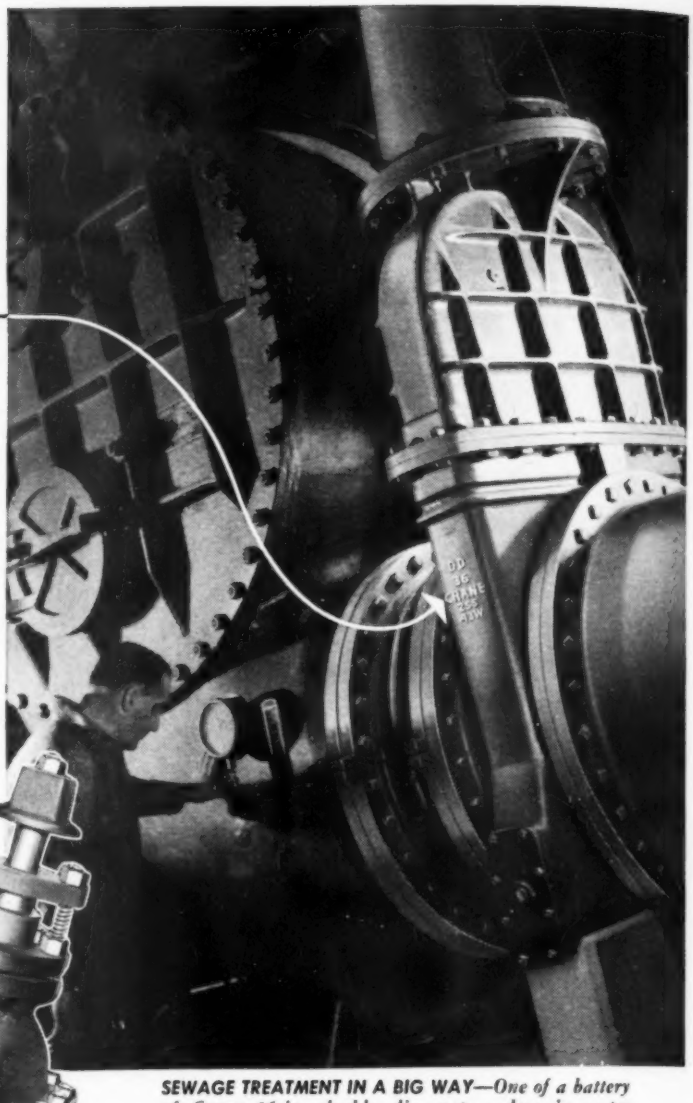
you see this name on valves

... In water and sewage works ... in communities big and small. And for good reason!

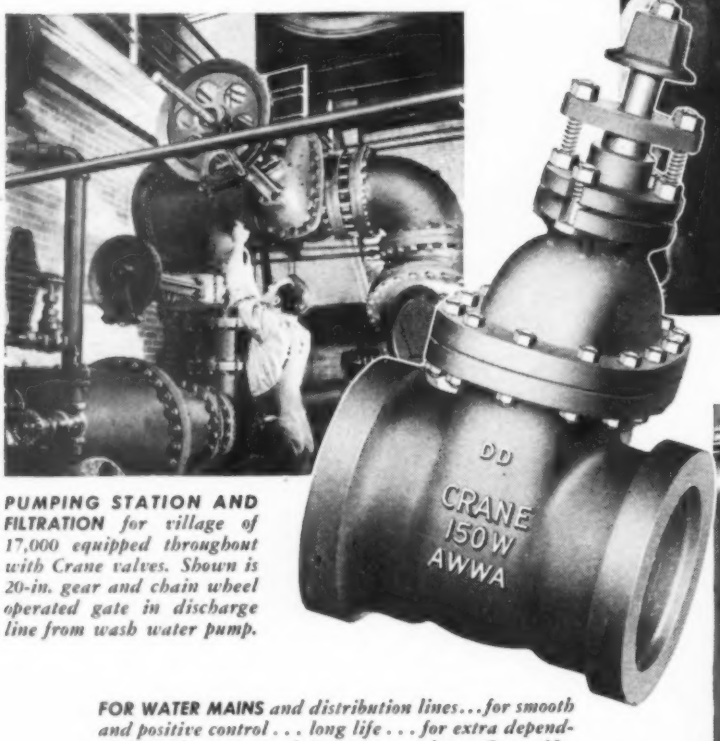
Together they grew up ... the nation's public water services and Crane. Together, by steady development of flow control equipment, they have safeguarded public health.

In valves as in fittings, Crane Quality meets today's highest standards for water supply and sewage disposal practices. To the men who specify for these services ... to the men who manage and maintain them ... Crane Quality assures maximum value and dependability in piping equipment.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Nation-wide Service Through Branches and Wholesalers

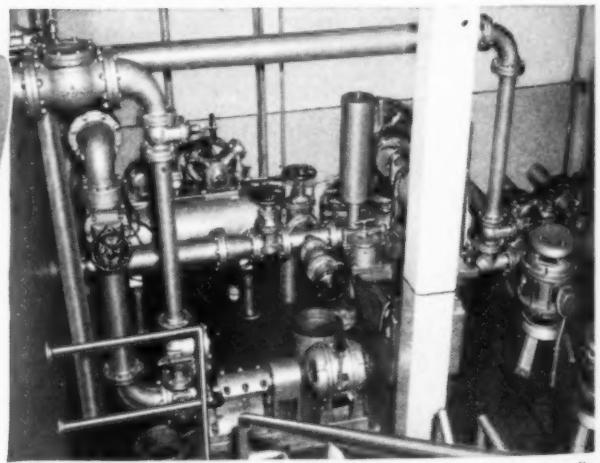


SEWAGE TREATMENT IN A BIG WAY—*One of a battery of Crane 36-in. double disc gate valves in water lines to exhaust steam condensers from turbo-blowers.*



PUMPING STATION AND FILTRATION *for village of 17,000 equipped throughout with Crane valves. Shown is 20-in. gear and chain wheel operated gate in discharge line from wash water pump.*

FOR WATER MAINS *and distribution lines...for smooth and positive control ... long life ... for extra dependability when you need it most ... choose Crane No. 480½ A.W.W.A. double disc iron gate valves. Brass trimmed; non-rising stem; hub ends. Sizes up to 12-in. rated at 200 pounds; sizes 14 to 36 in., 150 pounds. Complete specifications on page 126 of your Crane Catalog.*



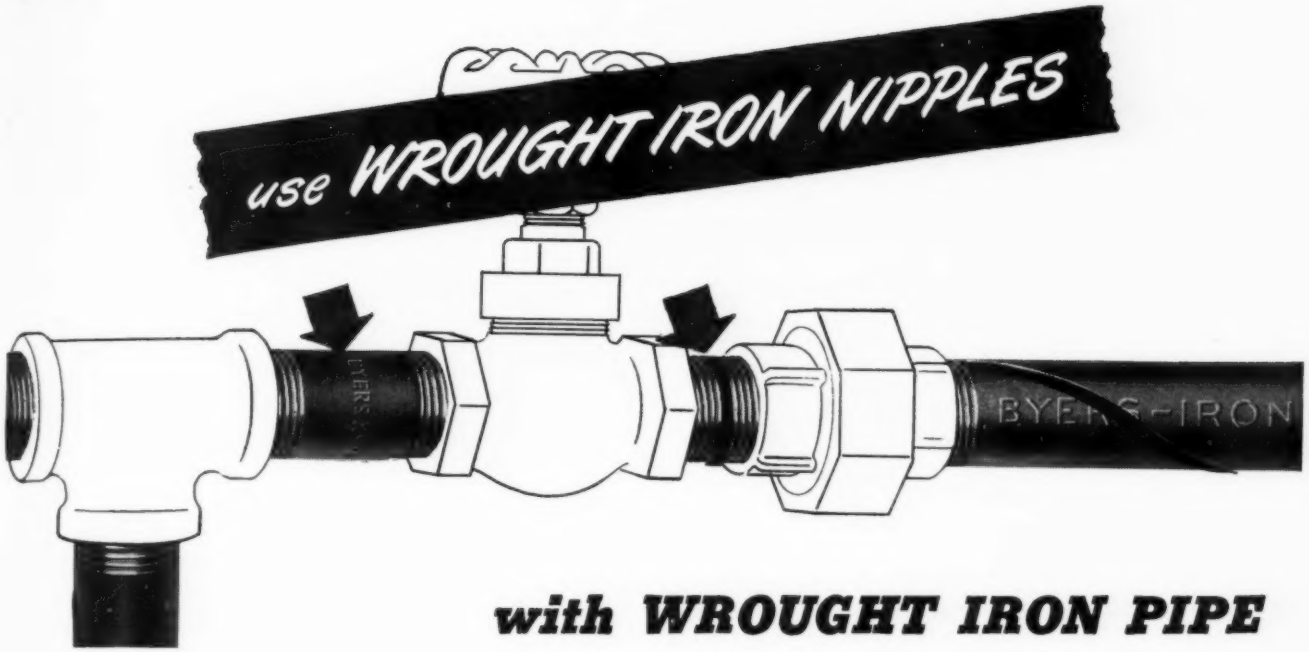
"SMALL TOWN" SEWAGE *and industrial waste disposal plant, showing Crane-equipped pump room handling hot and cold water, air, sewage gas, and sludge.*

VALVES · FITTINGS · PIPE

CRANE

PLUMBING AND HEATING

Avoid "Weak Links" in your piping systems—



with WROUGHT IRON PIPE

When you specify wrought iron pipe to lick some corrosion problem, assure 100% protection by specifying that the pipe nipples also must be wrought iron. Neglect of this simple precaution will leave weak spots in your lines, and set the stage for maintenance headaches.

METHOD OF SPECIFICATION

Merely stating that the piping "system" is to be black or galvanized wrought iron is not enough; the use of wrought iron nipples should be specifically designated. This may be done by requiring that the wrought iron nipples shall be made of pipe conforming to the requirements of A.S.T.M. Specification A72-45, Federal Specification WW-P-441a, Navy Specification 44P11k, or any accredited proprietary specification.

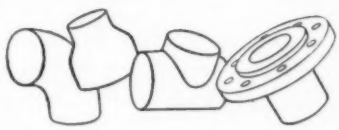
WIDE RANGE OF SIZES

Byers Wrought Iron nipples, both standard weight and extra strong, are available in a wide range of sizes and lengths, either black or galvanized. They are manufactured from new, tested, full-weight wrought iron pipe in accordance with the standards established in the specifications of leading technical organizations. All nipples are furnished with right-hand threads unless otherwise specified; nipples with right and left-hand threads are also available. Nipples are furnished "close" or to length as specified.

IDENTIFICATION

The word "Byers" and the weight —either "Std." or "X Stg." are machine stamped around the circumference of Byers Wrought Iron nipples. On close nipples, where it is impractical to stamp on the threads, a red band is used. These markings provide quick, positive identification of Byers Wrought Iron nipples, and help to avoid any danger of accidental substitution of non-durable nipples in the line.

IN WELDED SYSTEMS USE WROUGHT IRON WELDING FITTINGS



Wrought iron welding fittings are available in a wide range of types and sizes from leading fitting manufacturers. Just contact your supplier.

Wrought iron nipples are also available from a number of manufacturers. The identification used on such nipples may be learned by consulting the supplier.

INHERENT CORROSION RESISTANCE

The superior resistance of wrought iron nipples comes from the unique composition and structure of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

The best guide in applying wrought iron is a knowledge of its character and properties. The complete story is presented in the booklet, "The ABC's of Wrought Iron". Ask for a copy.

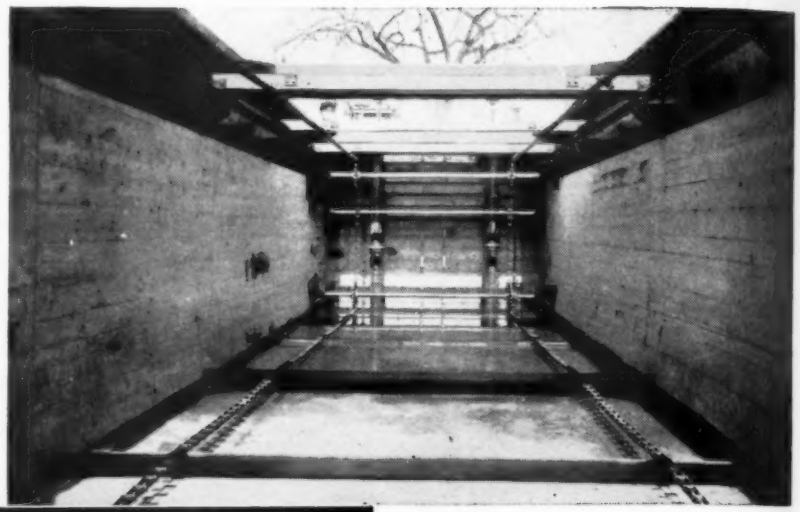
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Is SLUDGE and GREASE COLLECTION *Your Problem?*

Positive sludge and grease collection which is a necessity for an efficient plant, can be supplied by Link-Belt Straightline and Circuline sludge collectors. Link-Belt sanitary equipment engineers stand ready to supply helpful information and recommendations on applying the correct type of equipment to the solution of your special problems. Write our nearest branch office, today, for Catalogs 1742 and 1982, and for information on—



STRAIGHTLINE SLUDGE COLLECTORS

—for rectangular settling tanks, Straightline Collectors with peak-cap bearings, pivoted flights and "Straightline" action provide a combination which can't be beat for efficient collection of sludge and grease.

CIRCULINE SLUDGE COLLECTORS

—for round settling tanks. Circuline collectors are equipped with a "Straightline" action which assures quiet and positive sludge removal from the entire flow and in one revolution.

In addition to sludge collectors, Link-Belt Company manufactures a complete line of equipment for water, sewage and industrial waste treatment, such as grit collectors and washers, mixers, screens, scum breakers, aerators, dryers, power transmitting, elevating and conveying machinery. Send for catalogs.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

LINK-BELT

SCREENS · COLLECTORS · MIXERS · AERATORS

10,742

1,000,000th FOOT OF PIPE *Lined by Centriline*

Photo by George Van

The reconditioning of the one millionth foot of pipe by the Centriline Process took place in Newark, New Jersey, on April 21, 1948. This significant event was witnessed by many officials and engineers prominent in the waterworks field.

Newark was also the location of Centriline's *first* contract for centrifugally applying cement-mortar pipe lining—in September, 1935. Since then Centriline has reconditioned pipelines in many cities of the United States and in foreign countries.

Write today for our new bulletin. It will tell you the many advantages of the Centriline Process . . . . better still, let one of our hydraulic engineers consult with you on pipe reconditioning problems.

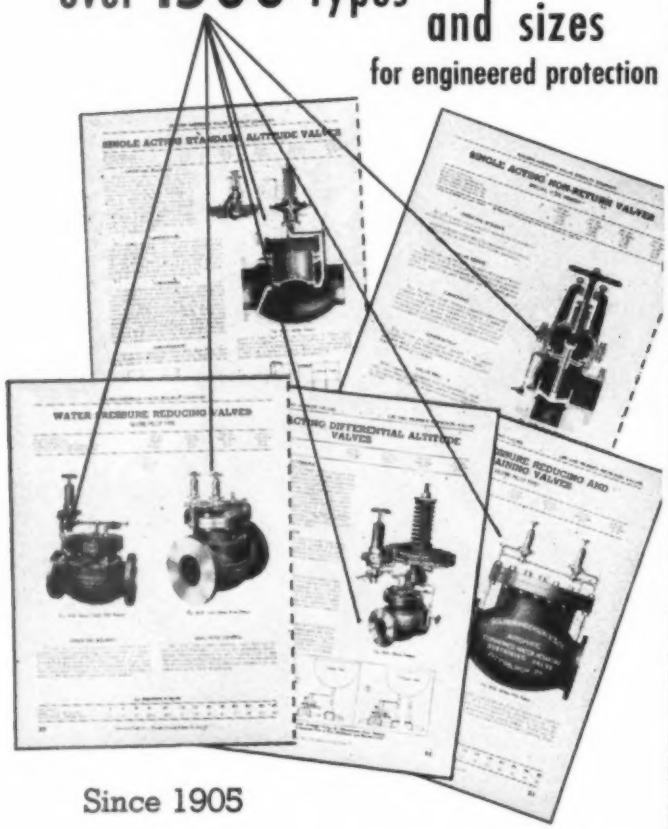
CENTRILINE CORPORATION

146 CEDAR STREET • NEW YORK 6, N. Y.

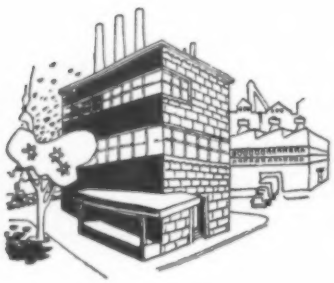
CEMENT MORTAR LININGS FOR WATER MAINS
CENTRIFUGALLY APPLIED
in strict conformity
with A.W.W.A. Specifications

Golden-Anderson VALVES

over 1500 types and sizes
for engineered protection



Since 1905



For more than 35 years Valves by Golden-Anderson have proven satisfactory in the protection of life and property. Engineer-designed to give safe, dependable control under even the most difficult and adverse conditions. For complete informative and technical data, send our engineering department your most difficult assignment.

GOLDEN-ANDERSON
VALVE Specialty Company
Keenan Building • Pittsburgh 22, Pa.

Plus Chlorine Minus Taste and Odor

PUT chlorine in to take taste and odor out. Chlorine, the standard treatment for water sterilization, is giving plus value to water supply by its ability to remove objectionable tastes and odors.

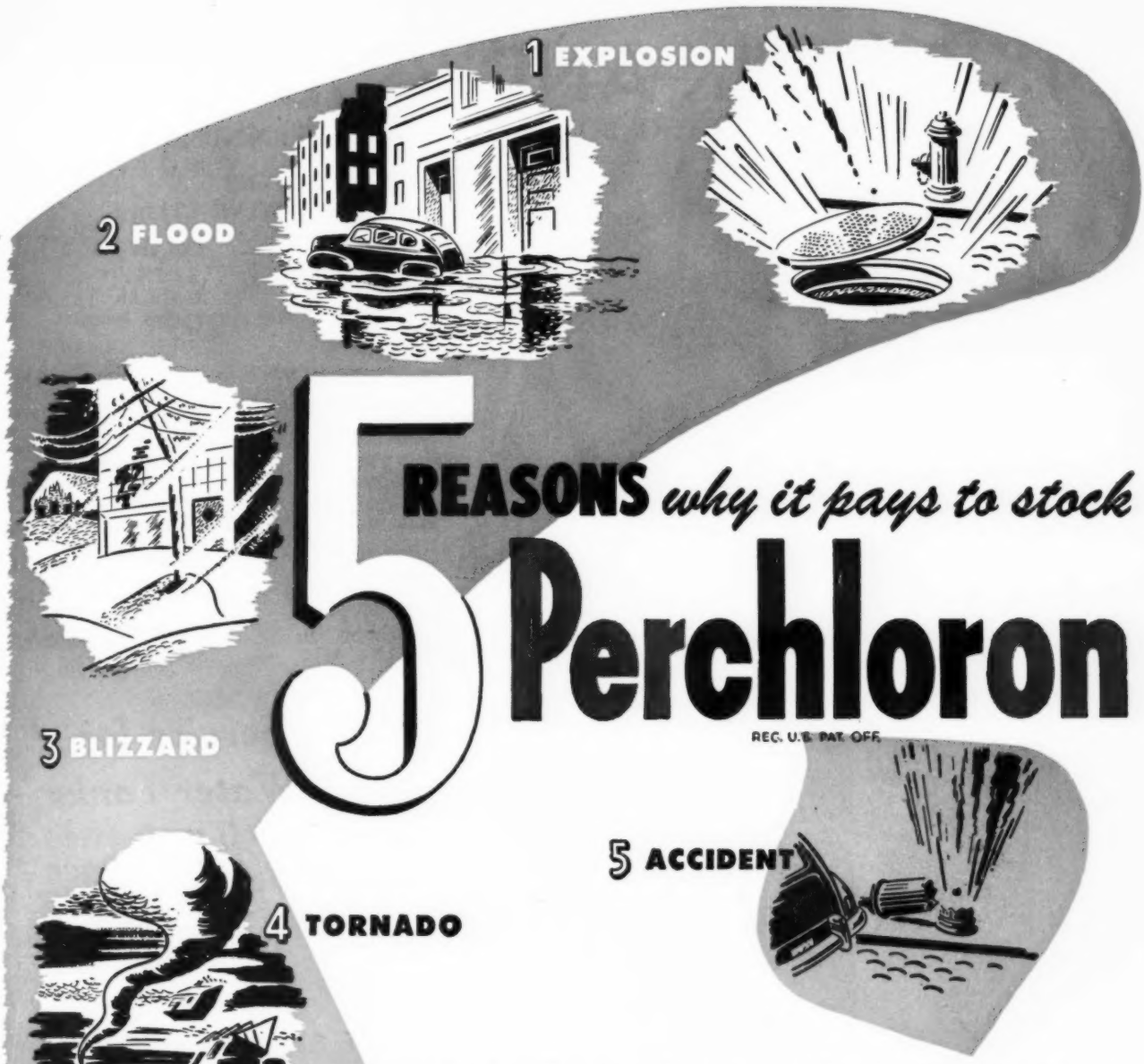
Superchlorination with later dechlorination... chlorine in conjunction with ammonia to form chloramine... continuous chlorination of entering water. These are some of the ways chlorine is being used to eliminate tastes and odors depending upon their cause.

There may be a choice about the method that will give you best results, but for the chlorine to use, there is no question. Hooker has been providing high quality, high purity liquid chlorine to water works, filtration plants and sewage systems for many years. Hooker's technical staff, continuously working with chlorine, has accumulated a fund of specialized knowledge that is available to you for help in overcoming and solving problems in handling chlorine. Call on them whenever you need information or assistance.

HOOKER ELECTROCHEMICAL COMPANY
Buffalo Ave. and Ward St. Niagara Falls, New York
New York, N. Y.
Tacoma, Wash.
Wilmington, Calif.

HOOKER CHEMICALS

Chlorine Caustic Soda 8512



5 REASONS *why it pays to stock* Perchloron

REG. U.S. PAT. OFF.

Yes, these sketches illustrate why so many alert engineers maintain a standby supply of Per*chlor*on.

They've found it pays to keep a stock of this handy calcium hypochlorite to help safeguard public water supplies in unforeseen emergencies. Per*chlor*on is stable and uniform. It contains over 70% available chlorine which means that 1 pound of Per*chlor*on is equal to 0.7 pounds of liquid chlorine.

Per*chlor*on is useful in other water treatment functions, too—sanitation of small water systems, new mains, wells, swimming pools. Its properties include the oxidation of ferrous iron in water, removal of hydrogen sulphide, control of most types of algae, and the destruction of chlorine-susceptible bacteria. Write for full descriptive material to Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT
CHEMICALS

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE.—P. O. BOX 14, MEMPHIS 1, TENNESSEE

THE SILENT WATCHMAN

REPRESENTATIVES IN THE FOLLOWING CITIES:

SALT LAKE, UTAH Box No. 1202
DETROIT, MICH. Box No. 1423
RALEIGH, N. C. Box No. 251
SYRACUSE, N. Y. Box No. 681
BUTTE, MONTANA Box No. 383
GREENVILLE, S. C. Box No. 1074
TAMPA, FLORIDA Box No. 1642
RICHMOND, VA. Box No. 886
NEWARK, OHIO Box No. 623
FARGO, N. D. Box No. 1472
COLUMBIA, S. C. Box No. 472
DALLAS, TEXAS Box No. 1881
DENVER, COLO. Box No. 2037
WAUSAU, WIS. Box No. 682
SAN FRANCISCO, CAL. Box No. 1445
COLUMBIA, MO. Box No. 522
SPOKANE, WASH. Box No. 906
MACON, GEORGIA Box No. 402
PROVIDENCE, R. I. Box No. 202

Complete Service for Elevated Water Tanks—

30 Years Experience

BE SAFE DON'T GAMBLE!

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress.

On completely re-conditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years. Yearly inspection, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

COPYRIGHT, 1947

THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

"Orgie, it's tougher than ever to pick a good vacation spot . . .

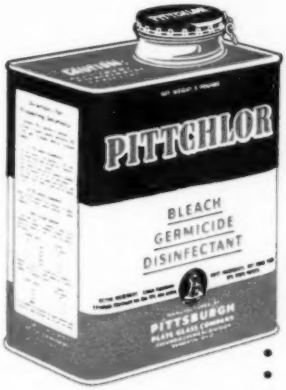
where there isn't a distributor of

PITTCHLOR"

Yes, Orgie, the outlook is pretty glum for you and your gang. And admittedly, you've really got something to worry about. For Pittchlor is "curtains" to chlorine-susceptible bacteria and algae.

A high-test, stable calcium hypochlorite—containing 70% available chlorine—Pittchlor is excellent for the chlorination of water supplies, the treatment of sewage, and for many other disinfection, deodorization and general sanitation purposes.

Pittchlor is efficient and economical, easy to use either manually or through relatively simple feeding devices.



Packed in 5 lb. resealable cans (9 per case), 3¾ lb. cans (12 per case), 100 and 130 lb. drums.

Distributors Note

Distribution opportunities for Pittchlor are still available in some areas. We suggest you check immediately. **Use this coupon to obtain complete information.**

Pittsburgh Plate Glass Company
Columbia Chemical Division, Dept. C-539
Fifth at Bellefield, Pittsburgh 13, Pennsylvania

Gentlemen:
Send me information on

☐ How I can become a Pittchlor distributor
☐ How to use Pittchlor for_____
(use intended)

Name_____

Company_____

Address_____

COLUMBIA CHEMICALS

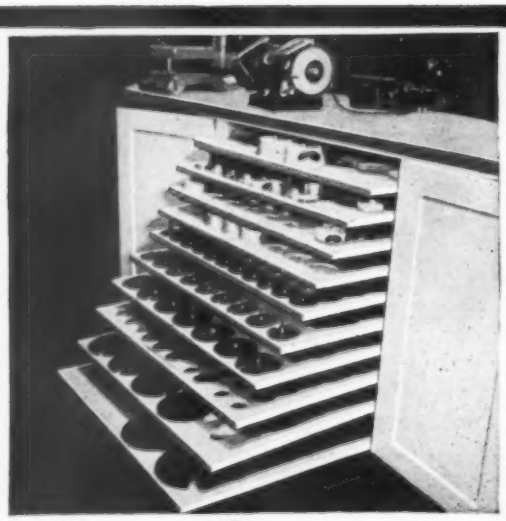
CHICAGO · BOSTON · ST. LOUIS · PITTSBURGH
NEW YORK · CINCINNATI · CLEVELAND · PHILADELPHIA
MINNEAPOLIS · CHARLOTTE · SAN FRANCISCO

PAINT • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

STANDARDIZE ON TRIDENT BECAUSE

TRIDENT *Interchangeability* MEANS *Economy in Inventory*



Danvers Demonstrates

Danvers, Mass., with some 3,500 Water Meters, has a compact meter shop of which its Superintendent, Mr. Roger Esty, is justly proud. An example is its unique "baker wagon" shelving, a cabinet with ten 38" x 27" shelves, in which meter parts are stored as follows:

Shelf No. 1 — 24	1" Disc Chambers
2 — 70	Clocks
3 — 48	⅝" Disc Chambers
4 — 40	¾" Disc Chambers
5 — 77	⅝" Discs
6 — 54	¾" Discs
7 — 35	1" Discs
8 — 70	⅝" Gear Trains
9 — 15	1½" Discs
10 — 12	2" Discs

Bottom caps, screws, nuts, bolts and other small parts are also readily accessible.

For all your Trident Meters, whether new or old, you need carry only one set of repair parts—the newest. The resultant economy in parts inventory, in the amount of storage space required, and in the records necessary to keep track of them, is an item which no Water Department should overlook.

NEPTUNE METER COMPANY • 50 West 50th Street • NEW YORK 20, N.Y.

Branch Offices in Chicago, San Francisco, Los Angeles, Portland, Ore., Denver, Dallas, Kansas City, Louisville, Atlanta, Boston.

NEPTUNE METERS, LTD., Long Branch, Ont., Canada

192

WATER & SEWAGE WORKS

VOL. 95, NO. 7 JULY, 1948

A Gillette Publication

DIGESTION OF SEWAGE SOLIDS

A Review of Established Methods; Comparisons and Comment

HEATED SLUDGE DIGESTERS

The Fourth Article of a Series

by

LeROY W. VAN KLEECK

Sanitary Engineer

HARTFORD, CONN.

OF the various methods for the digestion of sewage solids, none affords such precise control as that provided by heated digesters. Engineers strive for exact regulation of engineering processes, so it is logical that the sanitary engineer has developed present-day separate sludge digestion to a highly specialized degree.

The Author

Considerations in Adopting Heated Digesters

Plant Location

A study of Fig. I illustrates why heated digesters have such a wide field of usefulness in modern sewage treatment. In spite of the nearness of houses, no odor complaints during 16 years of operation have ever been received by those operating this plant. That such plants can be built in congested areas is an important advantage to the consulting and designing engineer faced with either limited land areas or the need of economizing on outfall sewers by using a central location. Plants in built-up areas treating septic sewage should practice prechlorination, however, to control those odors which emanate from the sewage itself and possess the power of travel.

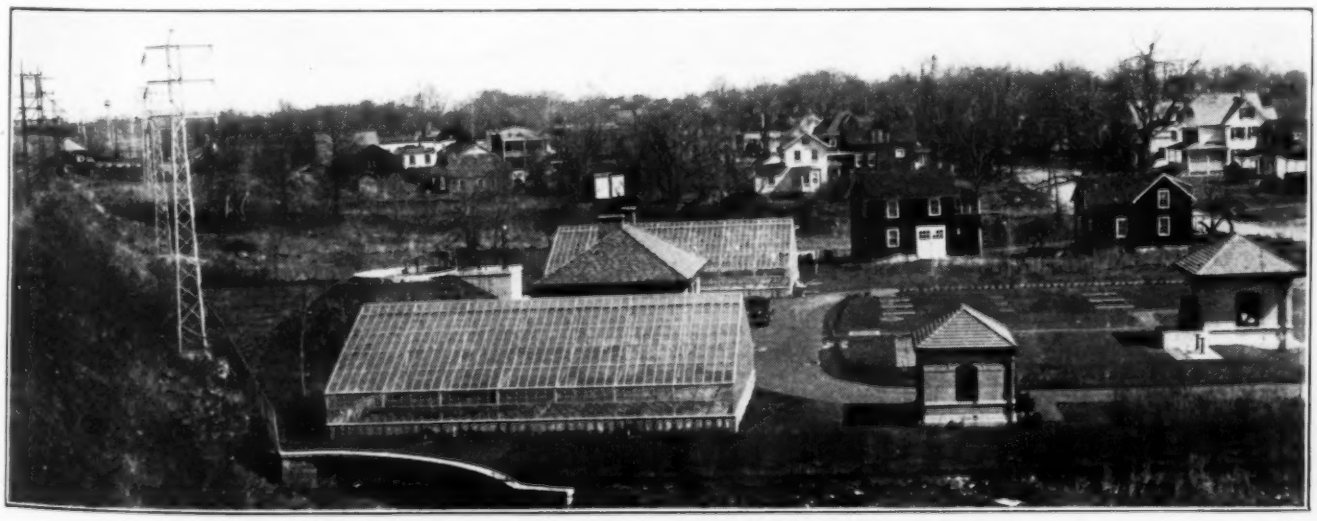


Fig. 1—Modern Heated Separate Sludge Digestion Plant.

Boasts a record of no complaints from closely located residences during 16 years of operation.

Connected Population

The writer has in earlier articles in this series suggested other types of digestion units for connected populations up to 5000. Imhoff tanks, in my opinion, continue to compete with heated digesters up to population loadings of 15,000 to 20,000. Provided that the raw sewage solids are responsive to digestion, there are few treatment plants in the higher population range that are not amenable to heated sludge digestion. In the case of very large plants, it is argued by some that a large digestion volume results in too high an initial outlay of capital and that its omission avoids an additional step in sludge treatment, which otherwise can be accomplished by vacuum filtering the raw solids and incinerating. On the other hand the author has previously discussed in *Water & Sewage Works*[1] the multitude of benefits derived from digestion, and reiterates his belief that most plants should enjoy its advantages.* Furthermore, the humus in digested sludge is sorely needed by many of our soils and efforts should be exerted to so direct its disposal to the practical limit.

*This statement applies to primary and humus sludges, and not to the vacuum filtration of raw activated sludge, which after heat drying frequently has a ready market as fertilizer.

Character of the Sewage

The raw solids in some sewages cannot, unfortunately, be digested, because of the presence of harmful industrial wastes in toxic or excessive quantities.

The wastes from metal processes such as copper, chromium, nickel or cyanide are bacterial inhibitors beyond certain limiting quantities.

Reported limiting quantities in the literature have varied. Copper or cyanide should probably not exceed 1 ppm. in the raw sewage; chromium not over 25-30 ppm. in sewage; nickel not much over 500 ppm. in the sludge, which may limit the quantity to 2 or 3 ppm. in raw sewages, These materials tend to be cumulative in the sludge, thus building up to hundreds of ppm. in the digester's contents with attending slow digestion and falling off of gas production.

While liming of digesters coupled with long digestion periods will sometimes permit a fair degree of digestion with some of these wastes, their exclusion or rigid control is imperative for satisfactory digestion.

Formaldehyde used as a disinfectant in some industrial processes is also an inhibitor of sludge digestion. Gilcreas recently reported digestion difficulties caused by formaldehyde following its use as a vat disinfecting agent in the manufacture of penicillin.

Fibrous wastes cause a mat of thick scum to form in digesters. This scum resists digestion; it increases in depth, thereby reducing the effective digester volume; it retards gas release; it limits the supernatant liquor zone; it causes failure of tank mechanical stirrers and often necessitates a periodical emptying of the digester contents. Wool fibre and hat fur are typical of these wastes. In Connecticut some plants have satisfactorily digested raw solids containing these wastes in the raw sewage where fine screening of raw sewage is used. Such screens have slot openings of 1/32-inch and remove substantial quantities of fibre from the sewage flow. Special digester facilities for scum removal have also been provided, including scum stirring mechanisms and means for direct removal of scum by draw-off pipes and access manholes.

Fig. 2—Waste Digester Gas Burner.
A standard appurtenance at heated digestion tank plants, burns surplus digester gas to preclude odor complaints and explosion hazards.

Canning and other industrial wastes affect digestion in varying degrees. Many wastes are bound to become a problem in our modern industrial age and all communities must take steps to work with industry in pre-treating or removing such wastes as are harmful to sludge digestion, not to mention the effect certain wastes may have on other plant processes or on the collecting sewers themselves.

Sludge Gas Utilization

The utilization of the gas produced by sludge digestion, coupled with the utilization of the digested sludge as a soil conditioner, undoubtedly has more popular appeal than any other phase of sewage treatment. Probably the first use of sludge gas was in 1895, when Mr. Cameron, Borough Engineer of Exeter, England, used it in a street lamp for lighting. The many uses for sludge gas at heated sludge digestion plants argues well for the use of the process. Such uses include:

1. Heating of digesters.
2. Heating treatment buildings.
3. Laboratory use.
4. Operating gas engines, which in turn are coupled to sewage pumps, air blowers or electric generators.
5. Source in whole or part for incineration or drying of sewage screenings or sludge.
6. Gas refrigeration.
7. Lighting.
8. Motor fuel in trucks. (For this purpose the gas is compressed to about 5,000 lbs. per sq. in. pressure. About 19 cu. ft. of gas will drive the average truck one mile, hence 170 cu. ft. is equal to about one one gallon of gasoline).

The major uses in this country are for heating of digesters and buildings and as fuel for gas engines. Now that dual-fuel engines have been developed which will operate with either sludge gas and fuel oil or sludge gas and gasoline, the use of such engines can be expected to increase at the smaller digestion plants (connected populations of 25,000 to 50,000).

Operating Personnel

The qualifications of operators for plants employing separate sludge digestion with gas collection have been detailed by the Operators' Qualifications Committee of the Federation of Sewage Works Associations[2]. Plants of this type serving communities of moderate size (5000 to 25,000 persons) can be capably operated by men having previous mechanical experience such as mechanics, plumbers, electricians or factory foremen. While the men themselves may feel lacking in the necessary chemical and sanitary knowledge to successfully operate such a plant, the writer's experience has clearly indicated that these men can be readily trained for the necessary laboratory work and in the the-

[1] *Water Works & Sewerage*, Vol. 86, No. 10, p. 415 (Oct. 1939).
*Connecticut State Dept. of Health.

[2] *Sewage Works Jour.*, Vol. 18, No. 1, p. 147 (Jan. 1946).

ory of the plant's processes. Such men are to be preferred for the smaller communities, since they have the "know-how" for "keeping the wheels moving". With instruction by local technical personnel, consulting sanitary engineers, or state supervising agencies, such men, if possessed with a reasonable amount of schooling, initiative and tact, make excellent operators.

Summary of Influencing Factors and Considerations

1. A central plant site can be chosen relatively near houses.
2. Connected populations of 5000 (sometimes less) and up can be served with all the advantages that are gained by digestion.
3. The sewage must not contain industrial wastes harmful to the digestive process.
4. Sludge gas utilization can be practiced.
5. The chief operator must be mechanically trained, have a reasonable amount of schooling (at least equivalent to high school graduation), and show initiative and ability to handle men. Large plants should be in charge of technically trained personnel.

DECIDING TYPE OF LAYOUT

The designer of heated digesters is faced with a dilemma at the start: "What type of layout shall he select?" Among the choices are:

1. To provide but one, or more than one, digester at small plants.
2. To use rectangular or circular tanks, with or without stirring of the tank's contents. The stirring equipment may be slow or high speed and may be accomplished by mechanical devices within the digester or by recirculating pumps located outside the digester.
3. To operate the system in parallel or series (i.e. single or two-stage digestion).
4. To furnish fixed covers, floating covers, gas holder covers, open top secondary tanks, or a combination.
5. To heat all tanks or only the primary units. There is also a wide choice of heating methods.

General comments on these lay-outs follow:

How Many Tanks?

Limited construction funds for small plants often require the use of a single digester. However, two tanks are desirable for flexibility in operation and for continuance of digestion whenever one tank may need repairs or emptying. When existing septic and Imhoff tank plants are converted to separate-sludge digestion type plants, an economical and very workable scheme used at several Connecticut plants has been to provide one heated digester with supernatant overflow and/or digested sludge storage in the old septic or Imhoff tanks. Such tanks have yielded overflow liquor of excellent quality, operated without nuisance, and provided a storage space for sludge during the winter or other periods when sludge drying facilities were not available. Old tanks used in this manner should be covered with treated wooden planking or preferably precast concrete slabs.

Another money-saving arrangement for some plants is the use of an open top circular secondary digester adjacent to the heated tank. The top of open tanks should be 12 or more feet above grade, or they may be located on a slope above surrounding structures, to dissipate any local odors. When properly operated and adequately designed, such tanks emit no odors of a travelling nature, serve as sludge storage basins during northern winters and discharge overflow liquor of good quality*. The scum in such tanks is readily accessible for breaking up or withdrawal when required.

When only one digester is built, a flexible piping arrangement that allows for emergency sludge storage in one or more settling tanks is suggested and may prove very useful.

What Type Tank?

Although the circular tank has the advantage of greater depth for sludge and supernatant separation, the writer has observed very satisfactory results from heated rectangular digesters,

*What constitutes good quality liquor will be discussed later under: "Operation of Heated Digesters."

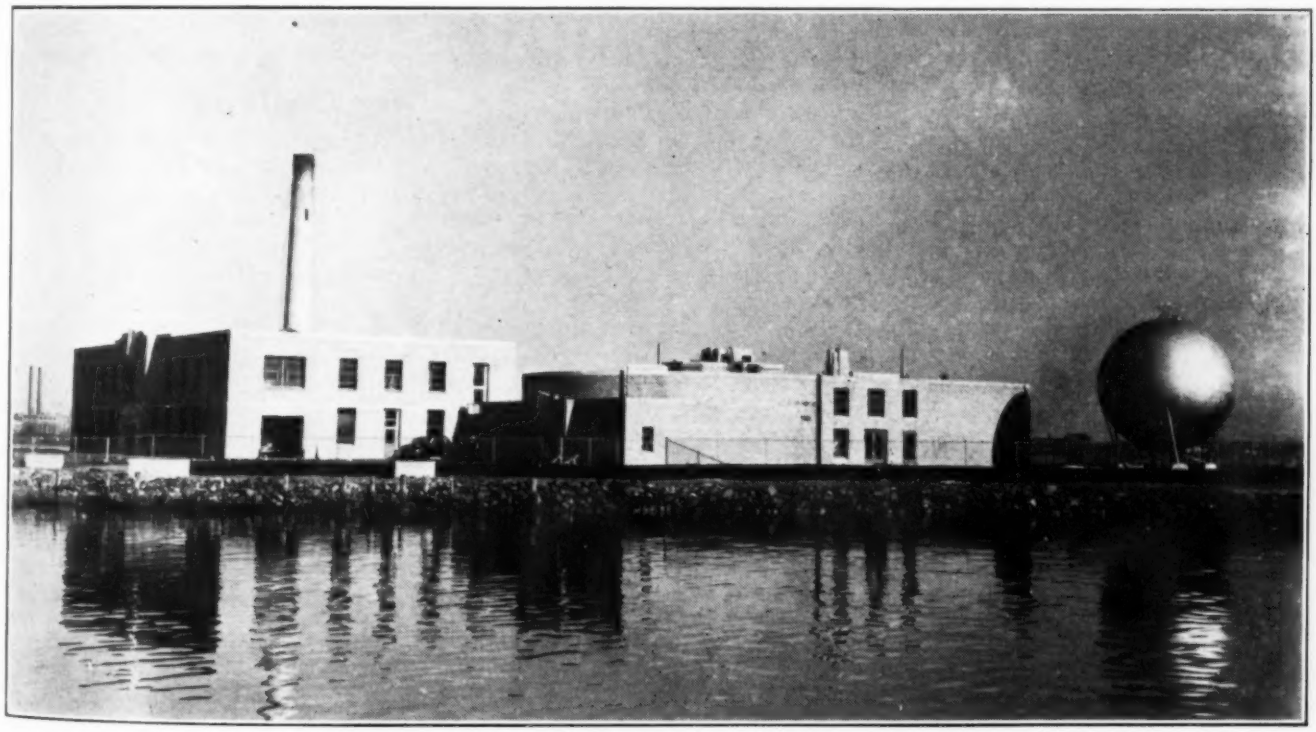


Fig. 3—New Haven's Modern Separate Digestion Plant.

Note pressure gas-storage Hortonsphere on right—sometimes referred to as the "bubble of progress" in sewage treatment.

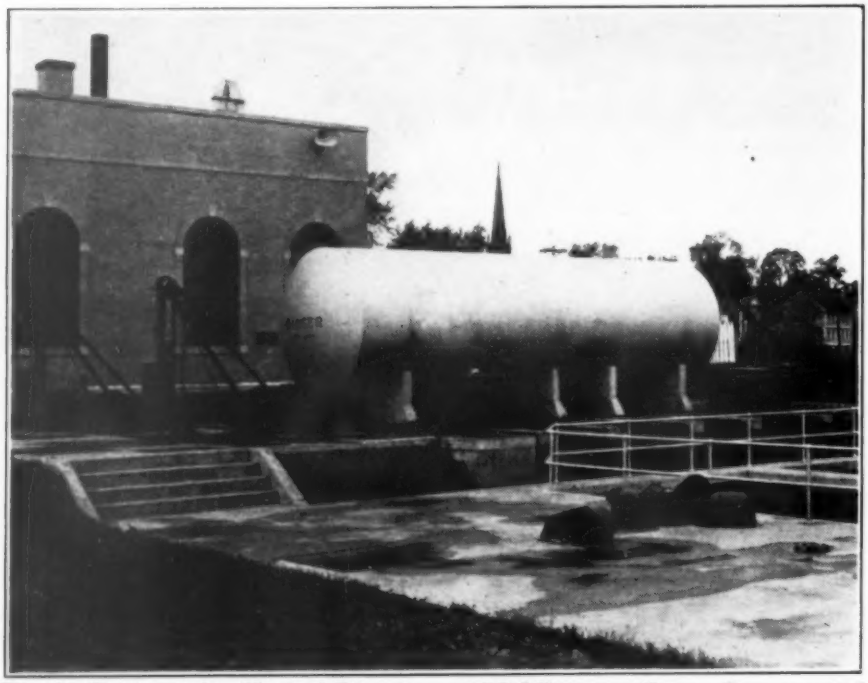


Fig. 4—Rectangular Heated Digesters at Middletown, Conn., Surmounted by Horizontal Pressure Gas-Storage Tank.

equipped with chain-drive slow stirring mechanisms. The designer's choice is sometimes dictated by the pattern of the land at the construction site.

Rectangular tanks equipped with fixed overflow liquor take-off should be provided with a take-off having at least two and preferably more overflow elevations. One should be about 3 feet below the maximum water surface; the other about 6 feet below. Such a design permits the drawing of supernatant from the zone of greatest clarity. The top action in a slow mechanically-stirred rectangular digester has been observed by the writer to soften and sink the scum or to concentrate it in moderate depths at the raw sludge inlet end, which is at the opposite end from the supernatant draw-off manhole. Here can be located large rectangular manholes from which, if required, the scum can be removed manually or mechanically. The bottom stirring action of the mechanism also aids in uniform gas production and in moving any grit in the sludge to the sludge withdrawal hopper, thus preventing its build-up on the tank bottom with resulting decrease in available digestion tank volmue. Circular tanks equipped with slow stirring scum and sludge mechanisms have similar advantages except that the scum layer is not so effectively separated from the point of overflow.

It is significant that slow stirring mechanisms for both circular and rectangular digesters, so commonly installed in the '20's and early 30's, have produced in many plants a well-digested heavy sludge, effective control of scum, and automatic grit removal. In contrast floating covers and rapid mechanical stirrers have failed in many cases to prevent scum build-up and of course do not gravitate heavy bottom solids to the sludge draw-off piping.

Recirculation of supernatant over the scum layer and modifications in high speed stirring devices are now proposed for scum control. The latter is in the testing stage, while installations of the former have been made. Both need demonstration and operating results at sizable municipal installations. Let us hope these results will be favorable because both methods will permit maintenance of the equipment from outside the digester. The slow-stirring type of scum and sludge equipment, as good as it is, does require emptying of the digester for major repairs, with attending inconvenience and occupational hazard. Adjustment of chains, mechanical wear, corrosion, painting and other repair work generally requires that slow stirring equipment be inspected every 3 to 5 years. With luck some plants have gone longer. Maintenance costs and the initial cost of slow-stirring equipment have predisposed many designers against ths type of tank.

Regardless of whether or not tank recirculation or stirring equipment is provided, some positive means for scum control is needed for heated digesters. Such means can be furnished without mechanical aids, although such aids, if effective, are much to be preferred. The writer has some concrete suggestions in resolving this problem which will be given later.

Parallel or Series Operation?

In the early days of separate sludge digestion, parallel operation, in which all digesters received about equal loadings of raw sludge, was generally practiced. About 1934, series or two-stage digestion began to be commonly employed. Three-stage digestion has also been used in some instances.

Parallel operation assures daily feeding of the bacteria and microorganisms in digesters, thus aiding in maintaining an equal and steady flow of sludge gas from all units. Foaming tanks can be rested and operation is somewhat simpler. Series operation concentrates the scum problem in the primary tank; the secondary tank sludge can be concentrated, and thereby may contain a higher percentage of dry solids; but most significant is the reduced solids in the overflow liquor. The better quality of secondary tank overflow usually secured from series operation results from a cooler tank, lower rate of gas production, easier control of the solids loading, and less scum accumulation. Many designers provide the benefits of both methods of operation by installing a flexible piping arrangement, which permits use of either parallel or series operation. While there is a slight trend back to parallel operation at present, the writer believes a flexible layout is again highly desirable whenever two or more digesters are built.

What Type Cover?

All types of tank covers work satisfactorily. From the safety standpoint fixed-cover tanks must be kept full to the point of overflow. This may be accomplished in two-stage operation, by use of a gas holder riding on the gas system and filling any void created by drawing bottom sludge, or by a float-controlled device that will admit either plant effluent, or a water supply not cross-connected with a potable supply, whenever the digester level drops. Some of the older fixed cover tanks, of which many still exist, lack such positive means of preventing explosion hazard, and dependence must then be placed on carefully executed operating procedures.

Floating covers, within their limits of travel, are not only safe, but permit drawing of supernatant liquor following quiescent periods between raw sludge pumpings or digested sludge removals. The gas-holder type of cover is commonly used on secondary tanks with series operation, but can

be readily adapted to single digester operation. They are useful at small plants for storage of peak gas yields which can then be burned at night when gas production is frequently low. Such covers are also useful at plants needing auxiliary heat for incinerators, or for continuous gas engine operation. In addition, separate gas storage tanks of either cylindrical or spherical shape (see figures 3 and 4) are used at the larger plants.

How To Heat?

In series digestion usually the primary tank only is heated. Even in northern climates, however, it is not unusual for properly insulated secondary tanks to maintain temperatures of 70 F°. or better from the heated transfer liquor. Again in the interest of flexibility, there is a tendency today to provide means for heating both primary and secondary tanks.

Heating methods include hot water coils around digester peripheries; removable hot water coils hung near the center of digesters; hot water coils enclosed in the digester walls; Keefer's Kemp submerged gas burner[3]; live steam heating of raw sludge; direct addition of live steam or hot water to the tank contents, and heat exchange units located outside of digesters and through which raw sludge and tank supernatant are heated and recirculated by means of a pump. Miles, Rudolfs, Rawn, Bacon and Ludwig have recently discussed the subject in detail.[4]

[3] *Water & Sewage Works*, Vol. 93, No. 6, p. 236 (June 1946).

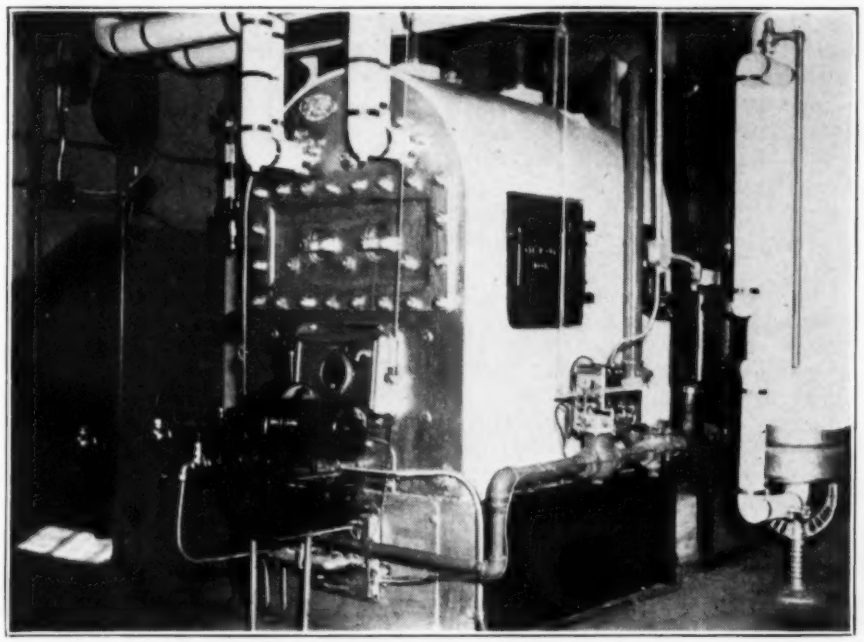


Fig. 6—Hot Water Boiler at Torrington, Conn.

Operates ordinarily on digester gas but is equipped for oil burning if and when necessary.

The great majority of digesters in use today are provided with interior hot water coils. The writer has observed good results with peripheral hot water coils, as well as with coils hung near the tank centers. By proper control of the in-going water temperature some plants have experienced continuous use of such coils for periods of 15 years and more. Some tanks have yet to be emptied for repairs or coil scraping. Many tanks have been heated for 10 years by this method and the coils are still producing satisfactory results.

[4] *Sewage Works Jour.*, Vol. 19, No. 2, p. 161-169 (March 1947).

The most positive assurance that safe ingoing temperatures are not being exceeded is to provide a *recording* temperature thermometer for each water heating circuit. A 24-hour chart on which is plotted the ingoing and return water temperatures gives the operator a permanent record for review, and from which he can make any necessary control adjustments. In addition such recording thermometers show by the temperature differential between the "in" and the "out" water, how effectively the coils are transferring the heat from the water to the digester contents. As the coils become incrustated, the differential becomes less and the need for coil scraping will become apparent. Funds might rather be spent for hot water temperature recorders than on the temperature of the digester's sludge, which varies but slightly in a single day under usual conditions. Dial thermometers, which are read several times daily, will suffice for sludge temperature readings at most plants.

A word about periphery coil location. In many early designs the coils were placed too near the tank bottom. The active zone of digestion should be heated; not the dead sludge. This suggests a coil position starting about one-third the tank depth from the bottom and extending to about the mid-

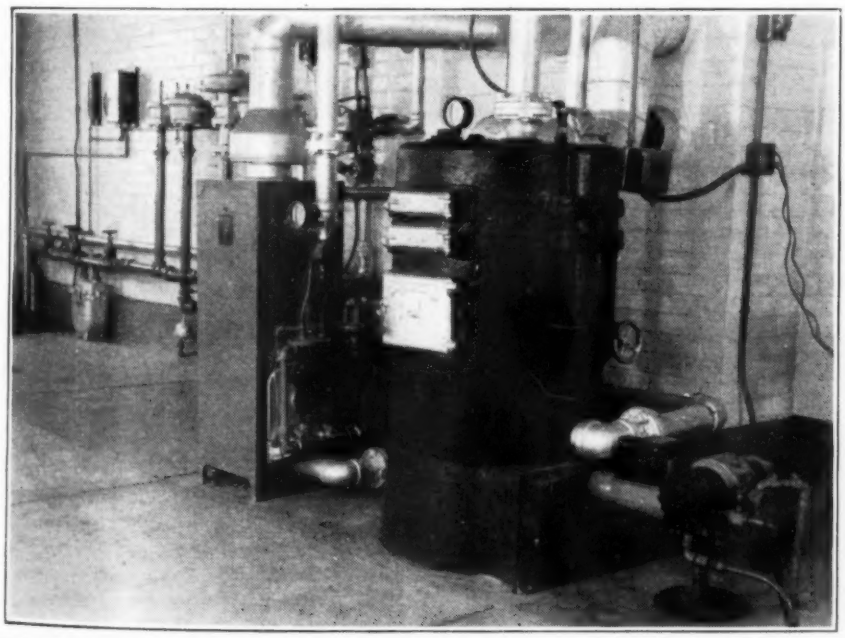


Fig. 5—Digester Gas Heating Furnace (left) and Auxiliary Oil Burning Furnace (right) at Putnam, Conn.

These units can be operated singly, in parallel or in series.

point of the tank. In Hartford, Wurts placed three sets of coils in the tanks, one near the top, one at the center, and one near the bottom. Hot water can be admitted to one or all sets. This permits heating of scum in winter, as well as providing a wide range of tank temperature without changing the temperature of the ingoing hot water.

The newer heat exchange units located outside of digesters are highly desirable and should prove more satisfactory than coils within the tanks. Kunsch at Urbana, Illinois, with one of the earliest municipal installations reports good results but points out that a single digester may produce poor overflow liquor in winter. The mixing of the tank contents by the recirculation method for long hours (as will be necessary in northern climates) creates this problem. A secondary tank or other means for liquor settlement or treatment appears the obvious answer to this difficulty.

Regardless of the method of heating digesters, a stand-by fuel in addition to sludge gas should be available, both for starting up of the plant and for auxiliary or emergency fuel needs. Fuel oil, coal, and manufactured gas have all been used in Connecticut with satisfactory results. Gasoline is another stand-by fuel where dual-fueled gas engines are employed with circulation of the jacketed hot water to buildings and digesters.

Manufactured gas and sludge gas are automatically mixed and burned in one boiler at two Connecticut plants. Where gas production is ample for winter heating of tanks and buildings, a boiler equipped for burning either sludge gas or fuel oil permits continuous heating if the gas supply fails. Fig. 6 illustrates such an arrangement. For small plants, producing insufficient gas for winter demands, two boilers, one on sludge gas and one on fuel oil or coal, operated in series, make use of all sludge gas produced and are therefore economical in operation. Fig. 5 illustrates the method.

("Design Features of Heated Digesters" will be discussed by the author in the next article of this series.)

Pollution Control Bill Passed in Last Minutes of 80th Congress

Carries Appropriation of $122,500,000

Just before adjournment the 80th Congress passed the Federal Water Pollution Control Act which provides for a total expenditure of $122,500,000 during a five year period. The Act becomes effective on July 1, 1948 and terminates June 30, 1953, unless extended.

It will be noted that $10,000,000 is appropriated as grants to state agencies for investigations, research, surveys and studies designed to develop methods of waste treatment and pollution abatement generally. Another $10,000,000 will be used for grants-in-aid to states, municipalities, interstate agencies, or other political subdivisions, for engineering and planning.

In the matter of low interest bearing, long term loans ($112,500,000 appropriation therefor), the smaller cities and towns are to be favored, in that $250,000 will represent the maximum loan permitted for the construction of any single plant. Municipalities will be given a loan representing 33.3% of the complete cost of the treatment plant, provided this figure does not exceed the $250,000 limit.

The general terms of the new Act are:

1. Loans are limited to states, municipalities, and interstate agencies for planning or construction of treatment works.
2. Loans are limited to one-third of estimated cost of treatment works, or $250,000 whichever amount is the smaller.
3. Authority is given to Federal Works administrators to make loans limited to $22,500,000 for each of 5 fiscal years (July 1, 1948, to June 30, 1953).
4. Funds are authorized up to $1,000,000 for each of 5 fiscal years (July 1, 1948, to June 30, 1953) to be allocated to States on an equitable basis for investigation, research, surveys, and studies.
5. Grants are authorized up to $1,000,000 for each of 5 years (July 1, 1948, to June 30, 1953) to States, municipalities, or interstate agencies, for engineering and planning.
6. Research in water-pollution control is encouraged by provisions above-mentioned and authorization of a laboratory at Cincinnati, Ohio, to house the work there established in 1913.
7. The language of the bill more definitely confines provisions to interstate streams.
8. All authorizations of loans, grants, and administrative funds are limited to five fiscal years (July 1, 1948, to June 30, 1953).
9. No loans or grants are authorized to private industries.

The terms of the Act relate *both to surface and underground waters.*

Southern Ill. Waterworks Operators Meet

The Southern Section of the Illinois Waterworks Operators held a spring conference at Mt. Vernon, Ill., on May 27.

Hosts for the meeting were Fred Abbenseth, Gen. Mgr. of the Illinois Cities Water Co., and Clifford Fore, Asst. Mgr.

The technical session held in the morning had papers on "Electronic Coagulation" by C. G. Haney, Chief Engr. of Alhydro, Inc., Baltimore, Md., and another paper on "Stability of Water" by Roy Graves, Chemist of Anheuser-Busch, Inc. During the afternoon, officials of the Illinois Cities Water Co. held a dedication ceremony at Reservoir No. 1.

The President of the Southern Section is Johnny Gustat, Supt. of Water at Johnston City, Ill., and Secretary is Carl Fraley, Supt. of Water at Murphysboro, Ill.

Ohio River Pollution Compact Signed

In Cincinnati on June 30, Governors from the eight States affixed their signatures to the Ohio River Valley Water Sanitation Compact. The participating states are: Indiana, West Virginia, New York, Illinois, Kentucky, Pennsylvania, Virginia, and Tennessee.

The Ohio Compact establishes a joint authority of the States for the purpose of abating and preventing pollution of the streams in the Ohio River Valley, combining the powers of the States, yet preserving their sovereignty.

The Compact affects the welfare of nearly twenty million people and includes more than 200,000 square miles of territory. Within the basin there are 140 cities with a population greater than 10,000.

Watson and Jennings to Represent West Va. in Ohio Valley Pollution Compact

Gov. Meadows of West Virginia has appointed Kenneth S. Watson and W. W. Jennings as members of the Ohio River Valley Water Sanitation Commission representing West Virginia.

Mr. Watson, engineer for the West Virginia Water Commission, was named for a term ending June 30, 1954, and Jennings, Chairman of the Water Commission, for a term ending June 30, 1951.

State Health Commissioner N. H. Dyer is an ex-officio member of the interstate group.

CONTINUED REPORT ON A.W.W.A. ATLANTIC CITY CONVENTION

THE first installment of the report on the A.W.W.A. Atlantic City Convention (May 3-7) appeared in the June issue of this magazine. That installment was devoted to the general story of the convention, the business of the meeting and such important topics as Sulphur Jointing Compounds, Air Conditioning, Public Relations, and Rate Increases. This second installment is devoted to Ground Water, Water Shed Problems, and Water Works Schools. The report on Plant Management and Operation Sessions, etc., will appear in the next and final installment. Elsewhere in this issue there appears the report on the Water Purification Division sessions and papers.

L. S. Finch
Ch. Engr.
Indianapolis Water Co.
Indianapolis, Ind.

G. E. Arnold
Dir. of Water
San Diego, Cal.

(Moderator and Summator of Panel on (Use of Reservoir Lands)

S. T. Anderson
Gen. Supt.
Water, Light & Pwr.
Springfield, Ill.

R. E. Bonyun
Gen. Supt.
Passaic Val. Wtr.
Paterson, N.J.

E. F. Dugger
Gen. Mgr.
Water Comm.
Newport News, Va.

Chas. E. Moore
Manager
Water Dept.
Roanoke, Va.

E. S. Hopkins
Assoc. Engr.
Bur. Wat. Sup.
Baltimore, Md.

H. B. Shaw
Dep. Ch. Engr.
Wash. Sub. San. Dist.
Hyattsville, Md.

Panel Discussion on Use of Reservoir Lands

WATER SHED AND RESERVOIR PROBLEMS

Panel discussions on WATER SHED AND RESERVOIR PROBLEMS were presided over by L. H. Enslow, acting as chairman, and Earnest Boyce, Prof. Civil Engineering, Univ. of Mich. The first of the two panel discussions had as Moderator, L. S. FINCH, Chief Engineer of the Indianapolis Water Company, Indianapolis, Indiana. This discussion was devoted to the question of "PUBLIC USE OF RESERVOIR LANDS AND WATERS AND PUBLIC RELATIONS ASPECT."

The first speaker on this subject was GERALD E. ARNOLD, Director of Water, San Diego, Calif. Mr. Arnold introduced his talk with the statement that one can not justify complete closure of areas to the public if adequate treatment of the water supply is available. In San Diego, where other bodies of fresh water are not available for recreation purposes, the city allows hunting and fishing, but no swimming. San Diego has a Division of Recreation Control. It furnishes certain camping facilities with sanitary facilities on certain lakes, or reservoirs. The Water Department furnishes a Book of Rules and the State Game Commission and Fish and Game Assns. cooperate in the enforcement of these rules. Public relations have been quite favorable and there is some revenue from the use of these reservoirs, the income during a year amounting to $50,000 or one per cent of the total revenue. This income is obtained from the rental of boats at $1.50 per day and for fishing licenses at $1 per person per day. Mr. Arnold stated that they had had little difficulty with infringement of rights or infraction of rules.

In Springfield, Ill., the city has gone all out for recreation, according to S. T. ANDERSON, Gen. Supt., Water, Light and Power Div. Mr. Anderson explained that before the Water Department could sell an idea to the city for a new reservoir it was necessary to agree that the public should have recreation facilities. Therefore, when the city voted to spend the funds to establish this new reservoir, the Water Department "went all out for recreation." There are two beaches and five parks, boat lockers and a wild life sanctuary, as well as a Lincoln Memorial Garden. Marginal lands are controlled and some five million trees and shrubs have been planted. Housing developments have been put up on certain marginal areas and these houses are rented. Swimming is allowed at the beaches. The water reaching the filtration plant shows little or no evidence of gas formers. Income from realty property is a substantial item and an outstanding feature of the whole project is the good public relations established with the consumers.

R. E. BONYUN, Gen. Supt., Passaic Valley Water Comm., Paterson, N.J., said that wherever water reservoir lands were beautified, the public would want to use them. He mentioned several things to consider before such lands are allowed to be used. Mr. Bonyun said that among the things to consider were source of supply, extent of treatment process, the time element and the period of storage. He believes that the areas should be restricted for use and that bathing should be prohibited in drinking water. There is now a New Jersey law under consideration to prohibit bathing at potable water supplies. Mr. Bonyun approves of permits for fishing and for boats, but objects to parks being constructed at the head works grounds, believing that they should be constructed upstream and back from the water.

A somewhat opposite view was expressed by EUGENE F. DUGGER, Gen. Mgr., Newport News Water Works Commission, Newport News, Va. Mr. Dugger said that in recent years, the thought had been increasing among

the population that the Government would take care of them and that the more services that are given to the public, the more they will desire. As a consequence, they desire to use the water reservoirs for recreational purposes. Mr. Dugger believes that where sanitary facilities drain back to the reservoir, they should not be used for any type of recreation. Fishing is hard to control. In the case of his own commission, fishing is allowed in one reservoir, but not in another, and the public appears to want swimming privileges, if they are allowed fishing and boating. Psychologically, the use of water supplies for swimming purposes is wrong. If there is any intestinal disturbance, the consumers are bound to blame the water, if they think it is from a swimmer. Mr. Dugger is of the opinion that a majority of people consuming water supplies do not believe in the use of reservoirs for recreational purposes—only a few are served and they are a small, although vocal, minority.

The city of Roanoke, Va. has a relatively young reservoir, according to CHARLES E. MOORE, Mgr., City of Roanoke Water Department. It is the only body of water nearby the city, however, and Mr. Moore said that if the water can be treated, it is difficult, if not impossible, for a water works manager to say no when the public asks for recreational privileges.

Mr. Moore says that the only real problem is the stubborn adult mind, pointing out that, even though bathing would not pollute the water, the mental hazard to the consumer is there and it is a mental hazard he would not care to buck.

At Roanoke, boating and fishing are allowed and controlled only to the extent that fish life is kept in balance. Power boating is controlled according to the reservoir, so as not to ruin fishing. When the lake level drops, motor boating is forbidden. The type of boat is also controlled and, in order to prevent accidents, sail boats are not allowed. Mr. Moore would like to discourage picnicking, because picnickers are not particularly clean in their habits. The Roanoke Water Department charges a fee for fishing and boating. In the case of Roanoke, it is obvious that, as the water level is drawn down in the reservoir, the likelihood of contamination becomes greater and the use for recreation is less desirable.

In reference to this same subject, EDWARD S. HOPKINS, Assoc. Engr., Bureau of Water Supply, Baltimore, explained that one of their reservoirs, containing twenty billion gallons, allowed fishing from boats and controlled shore fishing. Contracts were signed in 1946 with the League of Maryland Sportsmen. This was a reversal of the approach by the city, which now provided for certain types of recreation. It established the types of privileges, and gave printed rules for fishing and prohibited bathing, wading and swimming.

Boating and fishing is permitted, with a week day crowd of approximately 100, and Sunday crowds of 250. On the Fourth of July last, 575 persons availed themselves of the recreational facilities on this reservoir. Mr. Hopkins has noted no increase in bacterial counts but believes that the threat to public health is present. Mr. Hopkins pointed out that the small number of persons who use the reservoir for recreational purposes does not create a sanitary problem. These people are the most vociferous, but most of the water consumers are not interested. They would, perhaps, prefer that the water supply be retained for only water supply purposes.

HARRY B. SHAW, Dep. Ch. Engr., Washington Suburban Sanitary District, Hyattsville, Md., read excerpts from a report of the British Water Committee in reference to national parks. In Great Britain, it has been pointed out, national parks are mainly for recreation and water reservoirs in them are not desired by the British, according to the report. There are 12 national parks and many more conservation areas, and the report objects to water reservoirs in many of them.

The discussions, as presented by the several persons on the panel, were summed up by GERALD ARNOLD of San Diego. Mr. Arnold pointed out that there is a need for public relations and public education in reference to the use of reservoir lands for recreational purposes. Above all, Mr. Arnold pointed out that special privileges should not be allowed to anyone. If the privilege is given to one, it should be given to all.

In the discussion which followed, PROF. ABEL WOLMAN of Johns Hopkins University, Baltimore, called attention to the national parks problem here and commented on it in reference to the English attitude. Professor Wolman pointed out that there is a Congressional Act regarding the establishment of national parks in this country and that, generally, water supply reservoirs are secondary in national parks.

Harry Shaw completed his discussion by pointing out that he personally believes in the use of water reservoirs for recreation, but not in their abuse.

W. D. GERBER, former Ch. Engr. of the Illinois State Water Survey, Urbana, Ill., pointed out that Illinois reservoirs do not have restrictions. Where the personnel has been too small for control and policing, certain problems have developed, but, generally speaking, the cities in Illinois have all allowed recreational use of their water supply reservoirs. This includes Springfield, Bloomington, Decatur, Danville, etc., and certain industrial reservoirs for the Burlington and Santa Fe Railroads also allow recreational use.

NORMAN J. HOWARD, Supt. of Water Filtration, Toronto, Ontario, pointed out the difference between open service reservoirs and open distribution reservoirs. He believes that 90 per cent of the sanitary engineers are against the use of distribution reservoirs for any purpose and he believes that there is a hazard present when service reservoirs are used, particularly for bathing purposes.

Earnest Boyce
Prof. Civ. Engr.
Univ. of Mich.
Ann Arbor, Mich.

W. R. LaDue
Ch. Engr. & Supt.
Bur. Wat. & Sew.
Akron, Ohio

Percy A. Shaw
Engr. & Supt.
Water Works
Manchester, N.H.

Reservoir Lands Pay Their Way

RESERVOIR LANDS PAY THEIR WAY

With Earnest Boyce, Prof. of Municipal and Sanitary Engineering at the University of Michigan, Ann Arbor, acting as Moderator, a panel discussion was presented on the use of reservoir lands to pay their way.

Speaker on this panel was W. R. LADUE, Ch. Engr. and Supt., Bureau of Water and Sewerage at Akron, Ohio. Mr. LaDue reviewed the Akron

reservoir land story, which began in 1915, when a 750-acre reservoir was established. Now the Akron Water Department owns 8,000 acres, of which 19 per cent is in water reservoirs, 8 per cent in sugar maples, 32 per cent in farm tenants and 26 per cent in pasture and wood lots. Fruit trees, which were bearing at the time of the purchase, are gradually dying, although fruit is being sold as it is harvested. No new fruit trees are being planted to replace those which die off. A herd of 300 Hereford cattle and a herd of 300 sheep are kept as a minimum, the extra which are born each year being sold to market. The wood lots furnish lumber used by the Water Department, and 620 gallons of maple syrup are collected each year. Camping rights are leased and hunting is permitted at so much per day. The total income from the reservoir lands, including maple syrup, lumber, sheep, cattle, wool, and license fees, amounts to $21,500. The expenses for operating amount to $19,300. In addition to paying its own way, with some profit, the reservoir lands protect the $150,000 investment in land which protects the reservoirs. Before opening the reservoir lands to recreational use, the Water Department of Akron called in 17 organizations and developed a set of rules which established good public relations. By this means recreation has been controlled properly.

DWIGHT D. GROSS, Ch. Engr., Board of Water Commissioners, Denver, Colo., read the paper prepared by George F. Hughes, Manager of the Board. In Colorado, the water rights depend upon the owner of the land. Therefore, the reservoir rights likewise depend upon the owner of the land. The value of these rights depends upon the decree date. To protect itself and obtain the water rights, Denver has purchased considerable acreage in the past several years. In order to maintain these rights, the water must be used as it has been in the past. In one instance, an old mill must continue to operate, or the rights are lost. Grounds around the reservoir are leased and the revenue pays a fair return on the investment, the total income being some $19,000 a year.

"Forestry can be made to pay," was the opening statement of JOHN M. HEILMAN, Forester of the Newark Division of Water, Newfoundland, N.J. Mr. Heilman pointed out that forestry was secondary to water supply in Newark, but that it would pay its way. Disadvantages are the slow rate of growth, type of growth, the higher cost of production for municipalities than for commercial foresters, restricted sale difficulty, and the proximity to market. Newark sells boughs for Christmas decorations, and pine timbers for mines, rough lumber for which there is a big value. No money is spent on the forestry lands unless it will pay off. Income is kept at a minimum since a forest is a long-time crop. In twenty years, you can cut one and a half million board feet annually. At the present time, the cost of operation is $6,000 per year. It is expected that in 20 years, the income will reach $35,000 a year, the cost only $18,000 a year. In addition to paying its way, it will maintain the area as a protection to the reservoir, and it is a good public relations project. Mr. Heilman believes that water departments which operate forest lands can well afford to hire a forester for that purpose.

In discussing the papers, WILLIAM C. MORSE, Supt., Seattle, Washington Water Department, stated that his department had 96,000 acres, two-thirds of which had been cut over, but all of which had been reforested. Twelve per cent of the reforestation has been manual, and the rest has been natural. Operating on a 90 to 100-year cycle, this amount of land could produce 35 to 40 million board feet a year forever, with good operation.

Among the other points brought out in this matter of silting of reservoirs and the protection from silting by the use of forests, CARL BROWN of the U.S. Soil Conservation Department, spoke briefly on this subject and stated that his department was available for consultation on problems of silting.

GROUND WATER

Two sessions of the convention were devoted to the subject of ground water. One of these was a general session presided over by N. T. Veatch, outgoing president of A.W.W.A., with co-chairman Robert Millar, Manager, Water Dept., Wichita, Kans. J. A. Carr of Ridgewood, N.J., acted as Associate Presiding Officer.

The first paper on the general session was titled "THE DEVELOPMENT OF GROUND WATER" and was presented by E. W. Bennison, Office Engineer of Edward E. Johnson, Inc., St. Paul, Minn., who said that ground water was an important natural resource, the development of which had changed as a result of the interest in the economics of this source.

In the development of ground water, the first essential is to put down test holes and in order that the results of test holes may be accurate and dependable, they should be at least four inches in diameter. Mr. Bennison described the six methods of making test holes, three of which use water, and three of which do not. In studying the results, the hydrologist must know which method was used as there are certain rules for testing and formation sampling. Well drilling is an old profession and there was little improvement in it before the Civil War. Modern well drilling is less than 100 years old.

L. E. Blakeley
Cons. Engr.
Santa Ana, Cal.

H. T. Critchlow
Ch. Engr. Water
Policy Comm.
Trenton, N.J.

Abel Wolman
Prof. San. Engr.
Johns Hopkins Univ.
Baltimore, Md.

Ground Water Problems and Policy

On the matter of well construction, Mr. Bennison said that there is a relation between diameter and depth to yield as well as a relation between screen area and draw-down to yield. Materials proposed for use in well construction should resist incrustation and corrosion. A properly drilled well should make the maximum water available with the least draw-down per gallon of water discharged. Furthermore, any particular well should draw only from the desired aquifer and should not permit water from other aquifers which might be undesirable.

Mr. Bennison pointed out that ground water is not inexhaustible and that conservation must be practiced. He defined conservation as using what you have available to the best advantage without waste. Although ground water is not inexhaustible, the

ground water in reserve exceeds the surface water supply, but Mr. Bennison says that inventories of this source must be taken and plans made for its proper use.

In the discussion which followed the paper, questions were asked on electric logging and the appearance of fine sand in wells. Mr. Bennison said that he had no experience with electric logging and that in some instances sand might be almost too fine to handle. Even the finest sand, however, if approached with the proper technic and the proper relation between the slats and gravel packing will keep sand out of the wells.

Controlling Ground Water

"POLICIES AND PROBLEMS IN CONTROLLING GROUND WATER" was the title of the paper presented by H. T. Critchlow, Chief Engineer, Div. of Water Policy & Supply, State Dept. of Conservation, Trenton, New Jersey. Pointing out that civilization depends on ground water and that the demand for it has shown its limitations, Mr. Critchlow said there have been developed codes and laws to control ground water in several states, the first being in the east in 1910.

Of the more than 10,000 waterworks in the country, 60 per cent or more are served by wells. These supplies are delivered to a consuming public of 22 million people. In New Jersey alone, 262 well supplies are in use for the service of one and a half million people.

Mr. Critchlow listed the following problems of ground water control: (1) Interference of one well with another; (2) overdraft where pumping results in lowering the water table; (3) pollution by salt water, sewage, or industrial wastes.

Many factors have influenced the increased use of ground water, including the improvement in pumps, treatment, demand of industries for ground water, air conditioning, increased population, etc. In many instances, the ground water table has lowered to the extent of loss of the wells, or near the coast, salt water intrusion has ruined the wells.

Mr. Critchlow spoke on the various legal attitudes towards ground water usage, pointing out that the common law right resulted in suits for damage and that the law of reasonable use applied the theory of common interests of landlords. Recently in the public interest ground water laws have been enacted as a police power and where reasonable these have been upheld in the courts. In New Jersey the Water Policy Commission permits ground water withdrawal on the basis of reasonable use. Within the past year New Jersey has enacted a law which gives the Water Policy Commission control over ground waters for both industrial and domestic use. Mr. Critchlow concluded with the statement that it was desirable that existing laws be improved and that the A.W.W.A. should sponsor such improvements.

This paper was discussed by R. O. VAN METER, San. Engr., Dept. of Water & Power, Los Angeles, Calif. Mr. Van Meter reviewed the California situation and pointed out that in California one end of the State is wet and the other end dry. Furthermore, industrial wastes (including mining) and the growth of the State have made water supplies inadequate. He discussed the supplying of dry areas from the wetter areas, mentioning the Hetch Hetchy system for San Francisco and the Colorado River and All-American Canal for the lower end of the State.

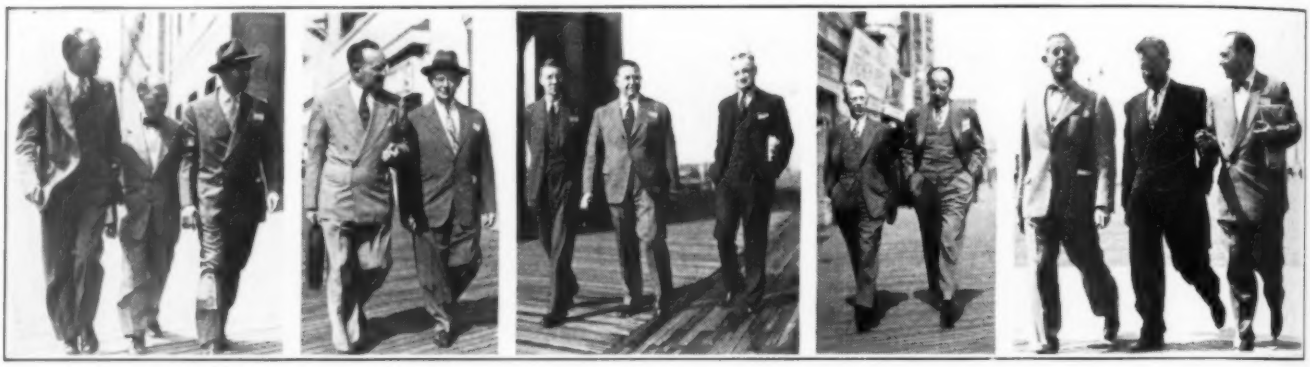
Storm waters are now sent to sea, but these could be profitably used for recharge of ground water supplies. There are now seven recharge basins in California and Mr. Van Meter said that recharge should be made at San Francisco to hold out salt water. Following the famous Montebello incident where industrial waste polluted a ground water supply, a legislative act provided $100,000 to study water pollution problems in California. These are now under study.

Artificial Recharge

"NATIONAL ASPECTS OF ARTIFICIAL RECHARGE OF GROUND WATERS," was the topic presented by A. N. Sayre, Senior Geologist, U.S.G.S., Washington, D.C., and V. T. Stringfield, Geologist, U.S.G.S., Washington. Mr. Sayre read the paper which emphasized the increase in water usage from 1850, when there were 83 water supplies, to 1945, when there were 13,000 supplies. Increase in irrigation, which is still growing, likewise has resulted in an accelerated use of ground water since 1935. In fact the ground water usage in 1945 was 20 billion gal. per day, or double that in 1935.

Mr. Sayre pointed out that hydrogination of coal, if it becomes successful, will require huge quantities of water. He further stated that all states will be forced into adequate water conservation control which the U.S.G.S. believes is a state problem. Control of industrial pollution by chemicals on the ground is needed and there is need for governmental control or mutual agreement to keep the usage of ground waters below safe yield.

As to the matter of artificial recharge, Mr. Sayre said that there are two types—wells may be located near



Convention Hall Bound on the Board Walk

E. A. Reinke, Berkeley, Calif.; T. R. Lathrop, Columbus, Ohio, and friend (?) — *G. R. Fisher, Palo Alto, Calif., and F. J. Reny, Portland, Me.* — *W. R. Catton, Brantford, Ont., Can.; J. B. Kinney, Toronto, Ont.; and Don Williams, Brantford, Ont.* — *S. R. Rankin, New York, and O. V. Lindell, Chicago (Dorr Co.)* — *Abel Wolman, Baltimore, Md.; A. E. Gorman, Washington, D. C. and H. H. Gerstein, Chicago, Ill.*

normal recharge area, which is an indirect method of artificial recharge, or they may be located where direct recharge is employed by diverting a surface source to the ground water level. This is most generally done by surface application, but it may also be done by wells driven to the aquifer. Among the problems to be considered in artificial recharge are the silting of basins, ditches, flooding methods, plugging of recharge wells, temperature effect for cooling waters, return to the ground waters, and taste and odors absorbed in the ground. There is no doubt, concluded Mr. Sayre, that artificial recharge will be a big factor in the future.

Rational Policy for Control

Speaking for the Committee on National Water Policy, the Chairman, Abel Wolman, Prof. of Sanitary Engineering, Johns Hopkins University, Baltimore, Md., presented a paper on "THE NATION'S POLICY WITH RESPECT TO WATER RESOURCES". In opening his talk, Dr. Wolman stated that the public water supply and sewage disposal field in this country is confronted with the probable expenditure of approximately eight billion dollars in the next five to ten years. There is also considerable expenditure expected in developing the St. Lawrence Seaway and other water resources. This, Dr. Wolman points out, is but a bare sampling of the prospect in water development and should give waterworks men some inkling of the perplexing problems which will plague the state and federal government within the next several years.

As to answering the question "What Should Be the Position of the A.W.W.A. on National Water Policy?", Dr. Wolman said that there could be no definite answer. There are many opposing views and viewpoints as to the development of water resources in this country. This is particularly true with the development of regional river basins.

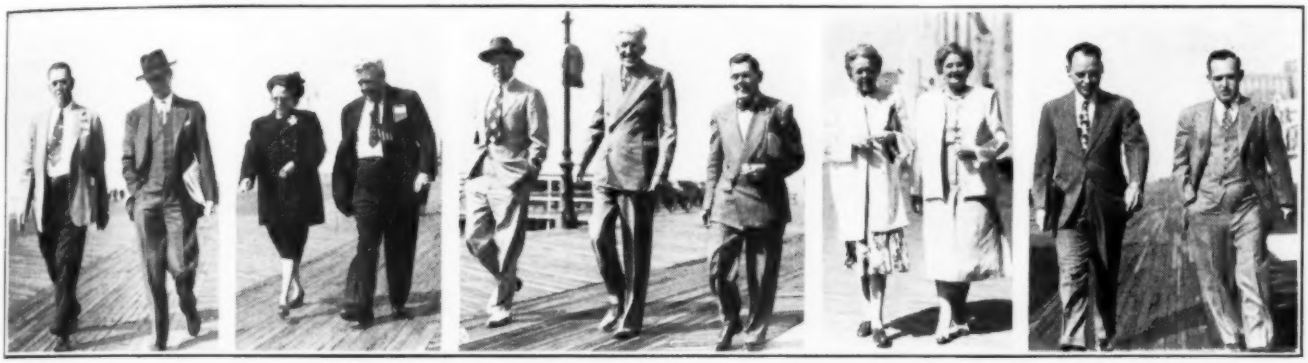
Considering all of these competitive beliefs and desires, the Committee on National Water Policy felt that its contribution to the Association would be to present certain general principles which might serve as a guide to individual members.

As to recent straws in the wind, Dr. Wolman mentioned the Senate Bill 2255 to establish a "national water policy conservation authority" and the Senate Bill 418 dealing with pollution control and water resources. In regard to the latter bill, the A.W.W.A. has already expressed itself as having a continuing and vital interest in the reduction of pollution of surface water. The A.W.W.A. has held that the primary responsibility for stream pollution control rests with the states, their political subdivisions, and the industries located therein. Furthermore, the A.W.W.A. has recognized that rivers do not respect state lines and the coordination and promotion of stream pollution correction can be facilitated by limited Federal legislation. Yet the Association favors Federal legislation regarding stream pollution control which will use to the greatest possible extent existing state and local authority, and it holds that in the absence of state and local action appropriate Federal agencies should be empowered to direct pollution control work.

In summary, the A.W.W.A. resolution has recognized the strong joint interest, local and Federal; it has attempted to preserve local economy, and it places emphasis upon the application of Federal government to provide for stimulation, planning, and integration. But this is not the sole answer to the problem of stream pollution control or the control of water resources in general.

Dr. Wolman emphasized that all of these items had elements of conflict and that all of the interested parties had ideas that were based at least in part on self interest, but from these various "ingredients of conflict" some general agreement appeared on the major elements of the national water policy and these the Committee set forth as follows:

A national water policy should (1) provide that first priority for water resources development be afforded to beneficial consumptive use of water for domestic, municipal, irrigation or general agricultural purposes; (2) provide for the preparation of plans for unified regulation and development of river systems of the country; (3) provide for a definite and effective program for construction of the projects included in such plans; (4) provide that programs be made adjustable to the exigencies of unemployment relief in periods of business depressions and of defense in times of danger; (5) take proper account of the economic special and existing benefits in considering specific projects; (6) limit Federal contributions towards projects to an amount warranted by all the national interests involved; (7) provide insofar as is practicable for an equitable distribution of project costs; (8) assist in the settlement of controversies between or among states over interstate waters; (9) provide for systematic and effective cooperation among Federal agencies and between such agencies, etc., and (10) eliminate inconsistencies and conflicts between or among existing laws and regulations relating to the control or utilization of water resources.



"On the Boardwalk at Atlantic City"

E. F. Dugger, Newport News, Va., and Elwood Aldrich, New York City

Mr. and Mrs. H. Lloyd Nelson, Philadelphia, Penna.

Fred Eidsness, Decatur, Ga., with A.W.W.A. Vice Pres. and Pres.—A. P. Black, Gainesville, Fla., and L. H. Enslow, New York City

Mrs. Chas. E. Moore, Roanoke, Va., and Mrs. Roger Esty, Danvers, Mass.

F. B. Strandskov and H. C. Marks (W. & T.), Newark, N.J.

Professor Wolman believes that if the elements of such a policy are developed on a Federal level and machinery to implement it is provided, it would necessarily bring into function concurrently one or another kind of regional group with strong state representation. Some such organization seems desirable.

Ground Water Symposium

(Reported by H. E. Hudson, Jr., Chief Engr. Ill. State Water Survey, Urbana, Ill.)

Something can be done about adverse ground water conditions. This was the keynote of the three papers in the Ground Water Symposium, May 4. The papers were on ground water situations on the two coasts, dealing with work on Long Island, N.Y., and at Santa Ana Gorge, Calif.

Balcony View of Head Table Happenings

From left to right—A Fuller Award; Retiring Pres. Veatch receives gift; the diners arise to greet incoming Prexy Enslow; another award.

The unique, widespread "GROUND WATER RECHARGE ON LONG ISLAND, N.Y.," by well owners under regulation of the Division of Water Power and Control, Conservation Department, was described by Arthur H. Johnson, Assoc. San. Engr., Jamaica, N. Y. Great progress has been made; today ground water levels are rising in Brooklyn. The problem is not fully solved, for there is continuing salt-water encroachment in some areas.

The law requiring that water taken out of the ground for cooling use must be put back underground was passed in 1933. Since then, 347 recharge installations have been made, chiefly in the heavily pumped area. Three hundred of these recharge wells are still in service. Standards of construction were drafted by the well drillers, and adopted in modified form by the state. Control over quality of the work results from the law licensing drillers to work on Long Island.

Recharge has grown from 29 mgd. in 1937 to 49 mgd. in 1947; most of it being through 100-550 gpm. return wells in the top glacial formation. All installations are metered and pumpages are reported monthly. There was a lively discussion on phases of this operation, particularly on control of sanitary quality, clogging of return wells, and methods of cleaning clogged diffusers (return wells).

M. L. Brashears, Jr., District Geologist, U.S.G.S., Jamaica, N.Y., devoted his presentation to the "TEMPERATURE EFFECTS OF RECHARGE OPERATIONS." The study, begun in 1936 under cooperation between the U.S.G.S. and the State Water Power and Control Division, has necessitated development of precision temperature-measurement methods. When warmed water is returned to the ground, there is a slow but progressive temperature rise. In case of continuous operation, the rise may be rapid, followed by a levelling-off at the new equilibrium.

The heated water tends to concentrate in the cones of depression at areas of heavy extraction, while in underpumped areas, it flows out of the area. Recharge wells usually affect their companion supply wells. The amount of the effect is dependent on the degree of heating of the returned water, which varies up to 30°, but is often but 5°. The temperature rise has averaged 3° for closely spaced companion wells, 1° for those spaced further apart. Questions were asked about pollution. Little has been noted, for return of contaminated water is not allowed. In response to a query by Prof. A. P. Black, Gainesville, Fla., Mr. Brashears said that some wells around Brooklyn have come to yield water of 12,000 ppm. chloride content.

A ground water diversion accomplishment was described by Loren E. Blakely, Cons. Engr., Santa Ana, Calif., and Victor A. Endersby, Res. Engr., Shell Development U., Emeryville, Calif. Their paper was titled, "CHANGING THE COURSE OF GROUND WATER FLOW." This work was carried out for an irrigation company which secures its water from a river whose flow tended to move underground in summer. Where the river passed through a comparatively narrow gorge, a bituminous cut-off wall was constructed in the permeable fill above bedrock, diverting the ground-water flow back into the river whence it could be taken to the irrigation canal. The wall was constructed by sealing the sand with an asphaltic emulsion injected through drive points while they were being retracted. Drive points were put down 4 feet o.c.s., sealing carried out, and a staggered second row was also sealed.

Fluorescein flow tests revealed ground water velocities in this area of 31 ft. per day, a very high rate. Mr. Blakely stated that this was an experimental installation, that costs were not completely worked out, but they were estimated at $2 per sq. ft. sealed.

GENERAL SESSION

One of the general sessions held on the afternoon of the first day of the meeting was presided over by outgoing A.W.W.A. President N. T. Veatch, Cons. Engr. of Kansas City, with Co-Chairman M. G. Mansfield, Cons. Engr. of Pittsburgh, and Associate Presiding Officer Laurie Leedom, Constr. Engr., Div. of Water, Newark, N.J.

Cone Valves

"THE USE OF CONE VALVES IN DISTRIBUTION SYSTEMS" was the first topic of the session. The speaker on this topic was Laurance E. Goit, Chief Engr. Water Works & Deputy Gen. Mgr. Dept. of Water & Power, Los Angeles. Mr. Goit said that in considering valves for distribution systems their purpose should be taken into account. There are two general purposes; one is to shut off for various reasons, and the second is for emergency operation in case of a break. The trouble with shutting off a gate valve is that it is slow, whereas rotary plug valves, or cone valves, may be opened and closed against pressure by one man. All sizes and all pressures can be opened and closed by one man. In Los Angeles the average pressure is greater than 100 psi. and it is hard to shut off even a 12 in. valve. Cone valves are easily shut off.

LAURIE LEEDOM, Constr. Engr., Water Div., Newark, N.J., also spoke on this topic, saying that control valves have progressed while other practices have not. The simplicity of the cone valve makes it possible to be operated at an unbalanced difference of head. Although they are more expensive to install, it is possible to use a smaller cone valve than a comparable gate valve because there is little hydraulic loss through the valve.

Mr. Leedom cited an example in Newark where a 48 in. gate valve requires 450 turns, requiring six hours to close. This valve is located on a

60 in. line. It was possible to put a 24 in. cone valve in that same 60 in. pipe and develop only a three and one-half in. loss of head which is equal to 1200 ft. of 60 in. pipe.

Mr. Leedom said that when small valves are placed in larger lines the reducer and the increaser must be eccentric. This gives several advantages. He suggested that the cone valves be specified to have corrosion resistant bodies and plugs. Newark is placing 16 cone valves in their system to replace 45 gate valves of 20 and 30 in. size.

Gerald Arnold, Dir. Water, San Diego, Calif., asked how often these valves must be operated. The answer was that they should be operated at least three times a year for both plug and gate valves, and four times a year if possible.

Mr. Borden of Philadelphia asked if by-passing was necessary and the answer was no. Mr. Longwell of Oakland, Calif., inquired as to troubles encountered with the operating mechanism. Both speakers said that the newer ones had given no trouble. Roswell Roper of East Orange asked about the time of delivery and received the reply that it was slow as is the case with all equipment. A. E. Bell of Essex Fells, N.J., asked about water hammer to which the answer was that it was possible, but not likely.

Gate Valves

"Operation of Waterworks Gate Valves" was the title of the paper presented by Donald M. Belcher of the Chapman Valve Mfg. Co., Indian Orchard, Mass. Mr. Belcher spoke of methods of operation of gate valves and the problem of opening valves on balanced pressure as against the problem of opening a valve against unbalanced pressure. By-passes are good only for filling pipe lines and are no good for large flows.

In answer to those who point to the long time necessary for manual operating and opening of gate valves, Mr. Belcher said that engineers should demand operating mechanisms for gate valves and he described features which make these valves easier to operate, such as ball bearing hand wheels which reduce the operating force by one half. Sliding stems are also helpful. According to Mr. Belcher, there has not been sufficient use of ball bearings and gears in the operation of gate valves.

Water Hammer

S. Logan Kerr, Cons. Engr. of Philadelphia, Pa., presented a paper on the "Practical Aspects of Water Hammer." Mr. Kerr pointed out that the A.W.W.A. had been interested in water hammer since it published the first translation of the Russian treatise in 1897. Although there are many factors which involve the theoretical considerations of water hammer, there are certain practical aspects which have a bearing on fundamental relations existing.

Mr. Kerr presented four fundamental relations which are essential for even a preliminary study of the subject of water hammer. These are (1) the velocity of flow in the pipe lines (V) which depends on size, type and age of pipe, etc.; (2) the length of the pipe line (L); (3) the time of valve operation (T); and (4) the pressure wave velocity (a). The pressure wave velocity is a basic requirement in calculation and it is affected by the thickness of the pipe wall, the diameter, the material of construction, and the elasticity of both the material and the flowing water. Each of these factors has a critical value with respect to the others, and Mr. Kerr suggests that the simplest and safest method of allowing for water hammer conditions is to consider only the flow line velocity as a finite, which is easily determined and to assume that the remaining three fundamentals are at their critical factors.

From the development of a simple formula it is possible to determine surge wave velocity.

Formulas and tables on the modulus ratio for various types of materials have been worked out by Mr. Kerr in a series of tables to give the information necessary to determine the value of (a). Thus he presents a series of curves from which one may determine for different ratios of inside diameter against thickness and different size pipe the value for (a) in the formula. It is then possible to determine the difference in surge pressure resulting from stopping any given flow in a pipe line, depending upon the diameter, thickness and material of construction of the pipe.

Mr. Kerr concluded that once the flow conditions and size recommendations have been set up for a given pipe line, whether it is a distribution system or long flow line or trunk line, the maximum instantaneous water hammer pressures above normal can be computed readily from the charts and tables included in his paper. If the allowance appears to be excessive and tends to increase the cost of pipe by a substantial amount, the possible use of lighter pipe for savings would justify further study.

Particular attention should be paid to valves installed for controlling flow. It is usually possible to adjust the time of closure to a matter of minutes rather than seconds so that the effective time will be long enough to avoid heavy pressure rise. Pressure regulating valves and other types of line controls can cause dangerous surges if not adjusted to sufficiently slow operating speeds.

In the case of a pump discharge line, particularly where adverse profiles are present, standard allowances for water hammer should not be used. Many other factors must be considered. For large diameter mains, 30 in. and over, Mr. Kerr says that the potential savings in the cost of pipe will usually justify some detailed study of water hammer conditions.

L. E. Goit
Dep. Gen. Mgr.
Los Angeles Water
Los Angeles, Calif.

L. M. Leedom
Cons. Engr.
Div. of Water
Newark, N.J.

Jos. P. Schwada
City Engr.
Milwaukee,
Wisc.

General Session Program

Laying Cast Iron Pipe

"The Proposed Revision of Specifications for Laying Cast Iron Pipe" was presented by J. P. Schwada, City Engr., Milwaukee, Wisc. Mr. Schwada quoted L. R. Howson to the effect that the distribution systems account for 66 per cent of the total value of the water supply. Inasmuch as it is buried and hard to maintain and repair, ample consideration should be given to the specifications for placing it originally.

The specifications should be limited to certain factors generally and de-

tails should be added as necessary in the addenda. The addenda, for example, should include schedule of progress, materials delivered, water to be furnished, restoration of payment, etc.

Mr. Schwada said the new rules should include disinfection or sterilization and the matter of leakage should be determined to be within a set formula as given by a table. Excavations and other features should also be included in the specifications. As proposed, the new specifications do not include any comments on sulphur joint compound, nor do they include chlorination of the water in the main. These specifications are now before the Committee for consideration.

WATER WORKS SCHOOLS

(This report prepared from material furnished by Harry N. Lendall, Professor of Civil Engineering, Rutgers University, New Brunswick, N.J.)

In the panel discussion devoted to the discussion of WATER WORKS SCHOOLS AND CONFERENCES, the presiding chairman was L. H. Enslow, President-Elect of A.W.W.A. B. A. Poole, Dir. Bur. of Envir. Sanitation, Indianapolis, Indiana, was co-chairman and R. S. Shaw, from the New Jersey Section, was associate presiding officer. Acting as moderator of the program was W. T. INGRAM, Engr. Field Assoc., A.P.H.A., New York City.

Mr. Ingram opened the meeting with a short discussion of facts and figures about water works operators and added to the discussion with interspersed comment between the several papers. The first paper on the program was presented by RAYMOND J. FAUST, Chief, Div. of Water Supply, State Department of Health, Lansing, Michigan. Mr. Faust pointed out that in-service training has grown in late years to be almost a necessity in all professions. In Michigan, the attempt has been made to provide training for all classes of operators (there are seven classifications in Michigan), and three separate educational opportunities are offered, the first of which dates back to 1933. In this first school, or special course, which was revised in 1947, there are five separate weeks of work during the summer. Each week comprises an independent course. These include, during the first week, Fundamentals of Mathematics and Chemistry, etc.; the second week, Chemical Laboratory Tests; the third week, Bacteriological Tests; the fourth week, Fundamentals of Water and Sewage Flow and Hydraulics; the fifth week, Methods of Operation and Maintenance of Water Supply and Sewage Disposal Facilities. A "student" may take any one of these weeks in any year, or take them all.

The second course of instruction offered to water works personnel was developed because of the desire for certain operators for academic home work. This did not work out, but, instead, technical subjects are taught by an instructor, one non-credit course being given each winter or spring term in seven different cities. The courses last 16 weeks, with a two-hour class one night a week. These extension courses are sponsored by the Michigan Section of A.W.W.A., the School of Engineering, the Extension Dept. of Univ. of Michigan and Extension Div. of Michigan State College, and the State Board of Control of Vocational Education. The Michigan Sewage Works Association is also a joint sponsor and introduced a new course on Industrial Waste and Stream Pollution Problems.

The third educational opportunity is a strictly high-level course. It is a two or three day meeting, held approximately every second year. A special faculty is brought together to discuss special technical problems in the water works field at the post-graduate level. Usually one subject is assigned to a day. From a practical point of view, the extension courses help in the preparation of candidates for examination for certification.

DR. A. P. BLACK, Prof. of Chem., Univ. of Florida, Gainesville, Fla., in speaking on the subject of Water Works Schools, said that the educational program in Florida was developed by a committee known as the Florida Committee on Water Supply and Sewage Education. On this committee are representatives from three colleges in Florida, and a representative each from the Florida State Board of Health, the Florida Section of the A.W.W.A., the Florida Water and Sewage Works Operators' Assn. and the Florida Sewage Works Assn.

Some Strolled While Others Hurried

Allan Williams and Al Brumley, Baltimore, Md. — *Ernie Bear, Livingston, N.J.* — *—Geologists All— M. L. Brashears, A. G. Fiedler, A. N. Sayre, Chas. Bechert, G. E. Ferguson* — *Chas. E. Moore, Roanoke, Va.* — *E. F. (Gene) Dugger, Newport News, Va. (Going) and H. E. Hudson, Urbana, Ill. (Coming)*

The Florida short courses are developed for men with sufficient educational background to benefit from the work in the elementary water section. Some men who attend have not had sufficient background to really benefit by the courses. In spite of the fact that Florida is a long state, Professor Black believes that municipalities will send their employees to training programs, regardless of distances, if these training programs deal effectively with the problems of those municipalities. Florida does not have a definite in-serve training program, but Professor Black believes that the new operator can probably be trained to some extent through an educational program at his own plant. The Florida Water and Sewage Works Operators' Assn. has a voluntary system of examination to certify Water and Sewage Plant operators. There is no state certification. Examinations are given twice a year, and the training schools help prepare the applicant for passing the examinations.

The first Water Works Short Course offered in New Jersey was held in 1931, according to H. N. LENDALL, Professor of Municipal and Sanitary Engineering at Rutgers University, New Brunswick, N.J. Courses are of the laboratory type and consist of approximately 25 hours of lectures and discussions and 25 hours of laboratory work, accompanied by lectures and an inspection trip to nearby plants. In recent years, these courses have been given on Tuesday's and Thursday's for a period of six weeks. The courses are offered by Rutgers University, in cooperation with the New Jersey State Department of Health, and the various water and sewage works associations in the state. Short courses are planned to recognize that there is a wide variation in the educational background of water works employees, but the courses present the fundamental principles of water works management, maintenance, and filter plant operation. Generally speaking, it is expected that the men attending the short course will learn something and will become acquainted with text books, magazines, literature, and will develop the urge to read and study on their own.

The fact that courses in New Jersey have been in operation for fifteen years and the majority of those in attendance have their expenses paid, indicates that both private and municipal water authorities do not look upon these schools as a vacation for those who attend. No academic credit is given for attendance. Prof. Lendall outlined one of the typical courses, given in February, 1948, pointing out that the program provided for approximately 21 hours on the Distribution System and 50 hours on Water Treatment. Professor Lendall feels that short courses at universities, for example, are worth while and are serving an excellent purpose. He does not believe that effective training can be given to the operator at his own plant.

The next speaker on the subject of Water Works Schools was EDWARD R. STAPLEY, Dean of Engineering at Oklahoma A. & M. College, Stillwater, Okla. Dean Stapley said that, in the southwest, annual three to five day short schools with one day district meetings and conferences were held in intervals, varying from one to twelve times per year, and are sponsored by the State Department of Health, the State Department of Vocational Education, and the Southwest Section of the A.W.W.A. Subjects for one-day meetings, held at scattered points, are of the non-laboratory type and are definitely limited to time and facilities available.

Dean Stapley pointed out that an interested person, attending any meeting, no matter what his previous training and experience, will absorb new enthusiasm in his work from his contacts with other men in the same field. What he actually learns from text books and demonstrations depends on a number of factors, including his interest, his willingness to work, previous education, and encouragement and incentives given by his superiors and employers.

Dean Stapley mentioned cases where city officials often employed persons without sufficient background and expected a short course to turn out thoroughly equipped operators in three days. This cannot be done. On the other hand, there are city officials that do not feel that "impractical professors at the college or the fault finding State Department of Health" men can give their employees anything of practical application or value to the community. Others believe that short courses are a "lark" and a waste of taxpayers' money, but generally speaking, there is a growing majority of water works supervisors and city officials who have proper appreciation of the scope and value of training available through short courses.

Dean Stapley believes that a well-balanced program can be made to cover the entire field of activity in providing safe water. Such a program should be planned to fit the needs of the trainees with various levels of education. Above all, the training for personnel should be made available to all departments and all personnel in every municipality. Dean Stapley concluded with a suggestion that State Laws and Codes, for example, the licensing of plant operators, provide a great incentive among water works officials and employees for additional training. If promotion and position or salary are based on such licensing, additional inducement will result.

The final speaker on this panel discussion was CHARLES R. Cox, Chief of the Water Supply Sect., N.Y. State Dept. of Health, Albany, New York. In New York State there is no state university, but the New York State Department of Health and the Conference of Mayors and Municipal Officials in the Municipal Training Institute, Bureau of Public Service Training of New York State Department of Education, and the Associations of Towns in the State of New York, together with the New York Section of the A.W.W.A., have combined to develop three-day short schools, located in various parts of the state. These are held at Cornell, Niagara University, New York University, and Rensselaer Polytechnic Institute, where the Engineering Departments make available time, facilities, and instructor personnel. Mr. Cox says the trainees who have attended these courses have benefited by receiving technical instruction to supplement available reading material, opportunities to ask questions and clarify their understanding of various subjects, as well as receiving a stimulus through contact with other operators, and a development of a better understanding of state agencies having contacts with local water supply officials.

No doubt Water Works Management expects broader training in the operation of public water supply systems than can be given at short schools, but, under present circumstances, the operator obtains the best possible training available. The field of training has included, most generally problems of water quality and safety, in preference to hydraulic, economic and office procedure. Mr. Cox believes a well-balanced training program for water works employees should embrace the whole system from source of supply to the ultimate tap of the consumer. Mr. Cox does not believe that in-service training can be easily provided to individuals, unless

Water Works Short Schools

W. T. Ingram
Engr. Assoc.
A.P.H.A.
New York City

R. J. Faust
Ch. Wat. Div.
Dept. Health
Lansing, Mich.

H. N. Lendall
Hd. Civ. Engr.
Rutgers Univ.
New Brunswick, N.J.

Ed R. Stapley
Dean
Okla. A. & M.
Stillwater, Okla.

they have had prior attendance at the short schools, but he believes that the need for in-service training is so acute that short schools should be supplemented by organized in-service training by a field staff or correspondence school.

In New York State, laws and codes set up operator licensing and these short schools have made it possible for a number of operators to gain their license or to advance from one grade to a higher grade.

Following the presentation of these several papers on the subject, the facts presented were summarized by Mr. Ingram, who had acted as moderator.

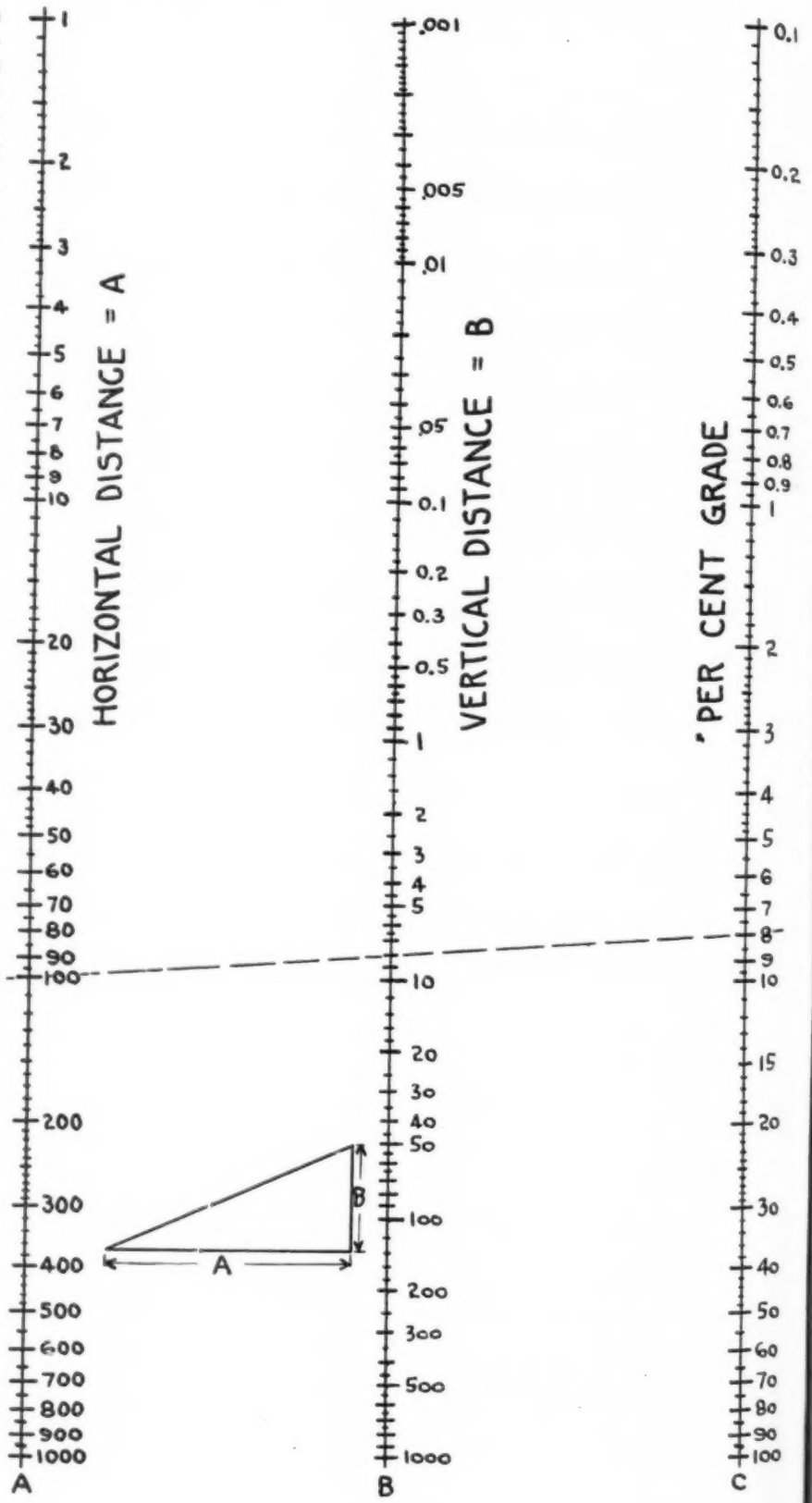
CHART FOR DETERMINING THE GRADE OF A ROAD, WALK, RAMP, ETC.

This chart will instantly give the grade of any road, or the like. Referring to the sketch drawn on the chart, grade is the height B gained after traveling a distance A, horizontally, divided by the distance A.

Thus for example if the vertical distance B is 8 feet and the horizontal distance A is 100 feet, dividing 8 by 100 we find that the grade is 8 per cent.

To use the chart simply run a straight line through the horizontal distance A, column A, and the vertical distance B, and the grade is immediately found in column C. The dotted line drawn across this chart shows that where the horizontal distance A is 100 ft., column A, and the vertical distance B is 8 ft., column B, the grade is 8 per cent, column C.

Column C includes all grades from one-tenth of one per cent to 100 per cent. Therefore the chart will handle most of the grade problems encountered in ordinary practice.



Contributed by W. F. Schaphorst, M. E., Newark, N. J.

Ben Nesin Succeeds Dr. Frank Hale in N.Y. Water Labs.

Benjamin C. Nesin, who has been associated with the New York City Dept. of Water Supply, Gas, and Electricity since 1927 has been promoted to the position of Director of Laboratories. Mr. Nesin thus fills the vacancy left by Dr. Frank Hale, who retired from the Dept. in November 1945. Mr. Nesin has been Acting Director since that time.

A graduate of Brooklyn Polytechnic Institute with a Bachelor of Science in Chemistry, Mr. Nesin received a Master's degree in Sanitary Engineering from New York University. In 1939, he was designated as Chemist in Charge of the Mt. Prospect Laboratory in Brooklyn. In recent years he has been responsible for the formulation and development of a new sanitary control policy for the New York City Water Department.

OPERATION OF SMALL WATER FILTRATION PLANTS

VI-Disinfection

A. E. CLARK
Manager
Nashville Suburban Utility District
NASHVILLE, TENN.

The Author

DISINFECTION is the safety factor in the production of a biologically safe water. Turbidity, color, hardness, iron, etc., are removed during the process of purification, but the process as such does not ensure the removal of bacteria which might be of a harmful nature. It is true that with the introduction of filtration for surface waters, before the advent of disinfection processes, there was a very great decrease in total bacteria and a consequent decrease in water borne diseases among those using filtered water. Filtration was a long step forward, but without means for disinfecting the finished water, there was always the chance of an unsafe water reaching the consumers.

The practice of disinfection started in this country in the early 1900's using chlorine which has proved the most valuable disinfecting agent as used for public water supplies. Ozone, ultra violet rays and silver compounds and bromine have been used, but not to any great extent.

Chlorine

The use of chlorine for disinfecting purposes is in general use on all public water supplies where the water furnished for drinking purposes is to be considered biologically safe. As stated above the use of chlorine dates back to the early 1900's when its use began to spread to more and more water supplies after its sterilizing properties in water had been determined.

The chlorine was introduced (as a water solution) into the water to be disinfected. Chlorine was purchased in the form of chloride of lime or bleaching powder which contained a maximum of 33 per cent available chlorine. This material was very unstable and when ready for use the percent of available chlorine might be anything up to 33 per cent. In order to make up a solution of uniform strength it was necessary to test each batch to determine the amount of chlorine. This strength, in turn, determined the quantity of bleaching powder to be used when making up the tank of solution for feeding into the water. Due to its highly corrosive properties, hard rubber, glass, or porcelain were used for conveying the solution to the orifice box and from there to the point of application.

The use of a constant head orifice box using a variable orifice assured as nearly as possible a uniform dosage, but it was necessary to check the apparatus frequently and keep it clean in order to obtain the best results possible. The use of chlorine in this form naturally led to experiments utilizing chlorine gas. It was only a few years later when apparatus was developed using chlorine gas in place of bleaching powder. Liquified chlorine gas rapidly supplanted bleaching powder for disinfecting public water supplies. The first chlorinating apparatus was somewhat complicated but constant experimental work, particularly, by the Wallace & Tiernan Co., has gradually developed apparatus for feeding chlorine either as a water solution or as the dry gas, by a relatively simple but rugged and accurate piece of equipment.

Handling Chlorine

Chlorine is a greenish-yellow gas about two and one half times as heavy as air. In the average small plant it is purchased in 105 or 150 pound cylinders, in which the chlorine is a liquid for the most part although a portion of the weight is as dry chlorine gas. Chlorine gas is very susceptible to temperature changes as for instance at 110 degrees F. the chlorine pressure would be 160 psi., whereas at 60 degrees F. the pressure would be about 75 psi. The cylinders should be stored in rooms where there are not extreme temperature changes.

Chlorine gas confined is not dangerous but when not confined is most dangerous. The operator should use every precaution when handling the cylinders. They should be stored upright and in case there is a leak around a valve every effort should be made to stop it immediately, but in any case put on a gas mask and play it safe. On the subject of gas masks the operator must never forget to check the cannister and keep a record of each time the mask is used as well as the duration. This is a safety precaution to prevent use of the mask thinking the cannister is all right when it has become exhausted. This may and can be the means of getting a severe dose of chlorine gas.

When changing cylinders connected to the chlorinator be sure that the valves are closed and that there is not excessive pressure in any part of the line conveying the gas to the chlorinator. Break the unions with caution and if there is a large quantity of gas, get away from it, holding the breath so as not to breathe in any quantity of the gas and put on a gas mask for further work or until there is not any danger of excessive gas. After the connections are made check all of them with ammonia and if there is even a slight leak repair it immediately because it will not take up but on the other hand will grow worse. Use the ammonia bottle freely, checking all connections regularly and when a leak is found repair it at once. In connections where gaskets are used, always install a new one if a joint is broken and always use gaskets furnished by the manufacturer.

Leaking chlorine gas is not only injurious to the individual but will soon ruin equipment in the filtration plant. Chlorinating equipment is relatively expensive, but if properly maintained will last a long time. Keep all exposed unpainted metal parts of the chlorinator coated with

a thin coat of vaseline. Keep the equipment clean both inside and outside. Know your equipment by studying the instructions furnished by the manufacturer and by all means follow these instructions. The manufacturer has spent years developing the simplest type of equipment consistent with the service required. Keep a few spare parts on hand and plenty of gaskets of the various sizes required. Use the wrenches furnished with the equipment and don't take up union connections too tight. If a new gasket is used the joint should be taken up snug. Probably more of this type of equipment has been ruined by using too much strength in making up the smaller joints than any other one thing.

Always use caution and observe all safety precautions when handling chlorine gas and it is suggested that a copy of *The Chlorine Manual* on chlorine use and handling issued by the Chlorine Institute (New York City) be secured and studied by every operator. Much of the material in this manual appeared in the July 1947 issue of *Water & Sewage Works*.

Disinfection

Chlorine used for disinfection only is fed into the water to be treated either as a water solution or as the dry gas depending on local conditions. The point of application also depends on conditions. Other results than disinfection are often accomplished by chlorination. One example of its extra benefits is where the raw water may be conveyed a relatively long distance through a pipe line and the carrying capacity of the line decreased due to growths in the pipe. The use of chlorine at the intake will usually prevent such growths and maintain the maximum carrying capacity of the line. Other uses include the removal of tastes and odors, removal of iron and manganese, improvement of coagulation, etc.

In cases of relatively heavy bacterial pollution it is advisable to prechlorinate, thus relieving the load on the filtration plant. If the prechlorination dosage is high enough it is usually only necessary to add sufficient chlorine after filtration to bring the residual to the point required for the water in the distribution system.

When development of chemical technics made it possible to differentiate between free available chlorine residuals in water and combined available chlorine residuals, then it became possible to establish that there are but two types of chlorination: Free residual chlorination and combined residual chlorination.

In the latter type of chlorination, the residual chlorine exists as a chloramine which has a slower disinfecting rate, but may be useful in taste and odor problems. It may result when natural ammonia is present or when ammonia is added, providing the amount of chlorine added is not sufficient to "destroy" the ammonia present. If the ammonia is "destroyed" and free residual chlorine is established it is known as the breakpoint treatment to produce free residual chlorination.

Where free residual chlorination is practiced, organic matter is oxidized, tastes and odors eliminated (even chlorinous tastes), bacterial kills are improved and water quality maintained in the distribution systems.

The dosage of chlorine depends entirely on the water being treated and there is not any rule by which one can say that a certain quantity of chlorine will provide a definite residual, without first testing the water to be treated. The quantity of organic matter and ammonia present will determine the amount required; and whatever method is used, whether normal dosage, break-point or chlorine and ammonia, the amount required is determined by actual test on the water under consideration.

The effectiveness of chlorine for disinfecting is determined by the results of the bacteriological examinations, both at the plant and at various points on the distribution system. These examinations should be made daily. The chlorine residuals at the plant should be checked frequently and tests for residuals at various outlying points on the distribution system should be made. Keep in mind that the chlorine is being added to produce a biologically safe water and be sure that the water furnished to the consumers is such a water. While the standards of the U.S.P.H.S. for drinking waters are rigid and possibly may not be carried out in some of the smaller plants, every effort should be made to maintain a water of the highest standard of purity.

Ozone

Ozone is an active form of oxygen and being unstable tends to break down into molecular and nascent oxygen. The nascent oxygen is a very powerful oxidizing agent and is active in oxidizing organic matter and killing bacteria. It is made in a closed apparatus by the discharge of high voltage alternating current between two electrodes using either dry atmospheric air or oxygen.

In order to be effective ozone requires very intimate mixing with the water to be treated. On account of the cost and care with which it must be added to the water it has not been adopted as a general disinfecting agent to be used in public water supplies.

Ultra Violet Rays

The destructive action of ultra violet rays on germ life is well known and this same principle has been applied to disinfection of water. Ultra violet lamps are placed in such a position in the water supply that there will not be a distance greater than twelve inches through which the rays must penetrate. The water must be turbidity and color free as any turbidity or color reduces the distance through which the rays will penetrate. Lamp renewals and current costs have made this process too expensive for the average public water supply and in the few places where it was installed, they have for the most part been discontinued and replaced with chlorine.

Silver Compounds

The sterilizing action of silver compounds and colloidal metallic silver has been known for a number of years, but it has only been in recent years that any attempt has been made to apply it in the disinfection of water. Some installations have been made on swimming pools, but due to its selective action it has not proved equal to other methods.

Bromine

No municipal supplies have used bromine for disinfection, but it has found use in many swimming pools.

R. S. Ingols Receives Sigma Xi Award

Dr. Robert S. Ingols of the Georgia School of Technology, Atlanta, Ga., was awarded the Sigma Xi research prize of that university for 1948. The award was based on his research paper "An Oxygen Consumed Test for Sewage" which appeared in the March issue of *Water and Sewage Works*.

This prize is given annually by the Sigma Xi Club of Georgia Tech for the best research produced in any science department of that school during the year. As a recipient of the award, Dr. Ingols presented a public address under the sponsorship of the Club. He spoke on city water supply at the Georgia Tech commencement program on June 8.

THE EFFECT OF UNCONTROLLED LOGGING ON STREAM TURBIDITY

J. A. LIEBERMAN and M. D. HOOVER*
U. S. Forest Service
ASHEVILLE, N. C.

GOOD water and good land management go hand in hand. Water supply engineers, foresters, and land use planners are learning more and more that the relation between water and the condition of land resources is intimate and continuous. The whole purpose of watershed management is to maintain this relation so that all the watershed resources may be utilized to their fullest advantage and economic extent. One of the problems that has arisen in connection with the maintenance of this principle is whether the harvesting of timber would jeopardize a city's water supply. Seattle's Cedar River watershed is a concrete example of this question[1]. There the controversy arose as to whether logging on the watershed should be continued or prohibited for the indefinite future. After detailed study an expert commission concluded that with the given climate, soils, vegetation, and other circumstances, "there are no inconsistencies in a policy and program which results in protecting the water supply values simultaneously with the conservation and use of the timber resources of the Cedar River watershed." Logging was continued. The commission also pointed out that "For over half a century lay and professional groups have argued with more heat than light about the effect of forest cover and forest practices upon precipitation and runoff. Even at this late date authoritative quantitive data which shed light upon these important effects are exceedingly meager."

The Coweeta Hydrologic Laboratory was established by the U. S. Forest Service to supply this lacking information for the southeastern United States[2]. This article is primarily concerned with the effect of forest practices on water quality. It describes in particular the increased stream turbidities resulting from a typical logging operation in the southern Appalachians. In addition, it indicates specific trouble spots and possible remedies.

*Division of Watershed Management and Protection, Southeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Asheville, N. C.

The Senior Author

Description of Area

The 5500-acre laboratory of the Southeastern Forest Experiment Station is situated in the Nantahala Range of the southern Appalachian Mountains which places it in the zone of maximum precipitation in the eastern United States and within the major water source area of the Southeast. The annual precipitation on the experimental forest varies between 65 and 90 inches depending on elevation, which ranges from 2200 to 5200 feet above mean sea level. Precipitation (of which less than 2 per cent is in the form of snow) is uniformly distributed throughout the year. The mean annual temperature is approximately 55°F. During the growing season, which is from April to October, the average temperature is 65°F. Natural vegetation on the experimental area is composed almost entirely of deciduous trees. There is an abundance of shrubs, principally rhododendron and laurel, in the minor vegetation. With the existing favorable climatic conditions, plant growth is rapid and is practically never checked by summer droughts. At Brevard, N. C., which is in the same general physiographic area as the Experimental Forest but about 60 miles to the northeast, at no time during the year is there any moisture deficiency or an over utilization of soil moisture[3]. The underlying geologic formation of the area is pre-Cambrian Carolina gneiss. The average depth of soil is greater than four feet and the soil is underlain by soft, disintegrated rock.

The Problem

At Coweeta we have been able to separate the effects of tree cutting from the effects of erosion caused by logging. The effect of tree cutting, with minimum disturbance of the soil, was determined on a complete 33-acre experimental watershed[4]. The runoff characteristics of the watershed were established from five years of continuous streamflow measurement. At the end of this standardization period all major vegetation was cut. To prevent any unnatural soils disturbance the trees were left lying where felled and were not removed from the area. As a result of this treatment, there was a 65 per cent *increase* in water yield from the area during the first year following cutting. This increase was entirely in the form of usable base flow. Thus it was demonstrated that in this climate the reduction of vegetation was not detrimental to the water supply *as long as forest soil conditions were maintained.*

When these forest soil conditions were disturbed, however, the water supply was adversely affected. From a nearby 212-acre experimental watershed, wood products were removed with the use of typical, local logging practices without any restrictions because of water values. In this case there were decided increases in stream turbidity and sedimentation.

As is typical of the southern Appalachians, this logging chance was characterized by steep, generally rough topography, with the valuable trees in scattered stands. Logs were ground-skidded by horse teams. Steep access roads and skid trails were constructed parallel and adjacent to natural stream channels, and comparatively little thought was given to their location and design. These latter deficiencies subsequently resulted in most of the erosion and the transportation of sediment into the stream.

Logging on the 212-acre experimental watershed was begun in June, 1942. In early 1946, in order to facilitate the operation, an access road 0.8 miles in length was bulldozed into the area by the logging contractor. In early 1947 he constructed a spur road about 0.3 miles long. To date approximately 900 cords of extract wood (wood for making leather tanning extract) and 170,000 bd. ft. of timber have been taken from the area. No logging or road specifications were set up for the operator and the whole

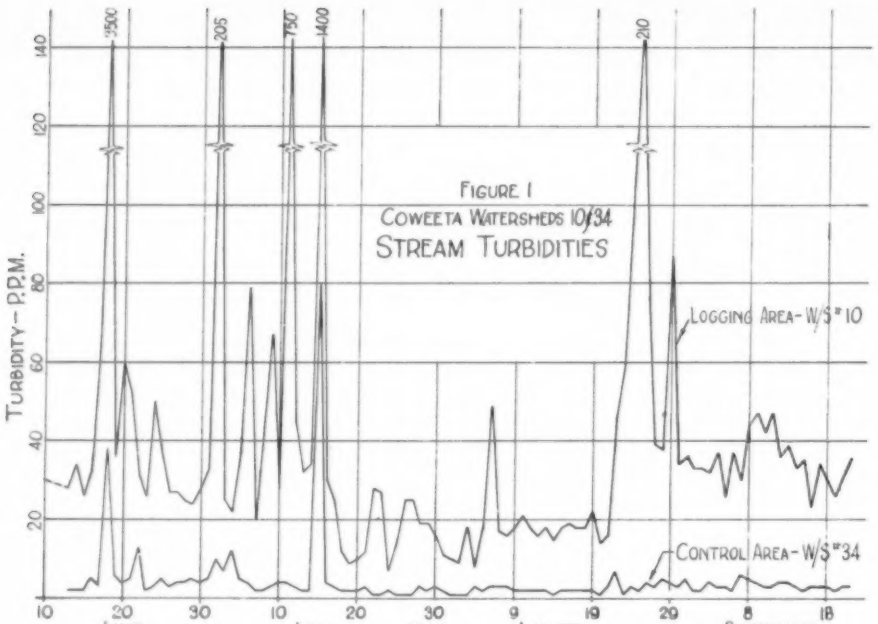


Fig. 1—Comparison of Stream Turbidities from Control Watershed and Logged Watershed.

situation is typical and average for the southern Appalachians.

Data and Results

The results of the logging were soon apparent to workers on the experimental forest whose general remark was, "that used to be one of our best drinking places, but it's too muddy now."

To measure quantitatively and systematically the changes in water quality associated with the logging operation, water samples were collected from the logged area (Watershed No. 10) and turbidities of these samples were compared with those collected from an adjacent control watershed (Watershed No. 34) on which there was no man-made disturbance. The daily samples from the two watersheds were obtained within fifteen minutes of each other. An analysis of the turbidity determinations for the period June 10 to September 21 shows that on the area that was being logged, the average turbidity was 93.7 parts per million. More important, the maximum turbidity was 3500 ppm. and the modal value of turbidity was 36.0 ppm. Comparatively, on the control area, the average turbidity was 4.3 ppm., the maximum turbidity was only 80 ppm. and the modal value of turbidity was 2.0 ppm. Table 1 gives this comparison in tabular form. Figure 1 shows the turbidity plotted by days for the two watersheds, and Figure 2 indiciates the daily precipitation during the period. As was expected, the higher turbidities were recorded when logging disturbance was followed by heavy rainfall. The results of a frequency analysis of the turbidities are shown graphically on Figure 3.

TABLE 1.
SUMMARY OF STREAM TURBIDITIES
Coweeta Watersheds No. 10 and No. 34, June 10 to September 21, 1946

	Watershed #10 Logged Area	Watershed #34 Control Area
	ppm.	ppm.
Average turbidity	93.7	4.3
Modal value of turbidity	36.0	2.0
Maximum turbidity	3500.0	80.0

Sources of Turbidity

Measurements and observations on the watershed readily revealed the sources of this turbidity. In the summer of 1942, during a three-months' period, 250 cubic feet of eroded material were collected from a portion of skid road 450 feet long and 5 feet wide on a 30 per cent grade. This is equivalent to an erosion rate of over 160 cubic yards per acre of road surface. Cross-sections of the access road measured at intervals showed lowering of the road level as much as a foot, with recession of the road bank (due mainly to frost action) of an equal amount. Wheel ruts eight inches to a foot deep and two feet wide were not uncommon.

How a small, local trouble spot may affect a larger stream system was brought out during the storm of April 11, 1947. Following this storm of 1.02 inches in 14 hours, samples were collected from (a) the stream draining Watershed No. 10; (b) from the main stream just above Watershed No. 10; (c) from the main stream, draining an area of 1800 acres, at a point below Watershed No. 10; and (d) from another main stream in the experimental forest draining slightly less than 1800 acres, on which there is no logging activity. The turbidities of these samples were as follows:

Watershed No. 10 (212 acres)	1200 ppm.
Main stream above Watershed No. 10	25 ppm.
Main stream below Watershed No. 10 (1800 acres)	395 ppm.
Another comparable main stream of nearly 1800 acres —(no logging)	25 ppm.

Thus it is seen that the origin of high turbidity in a larger stream may be traced to a fairly small or localized area.

Although no chemical analysis of the material causing turbidity was made, a visual examination of the samples from the two watersheds indicated a marked difference in the composition of the material. Generally speaking, the matter in the water samples collected from the logging area was of a finely divided mineral character with low settling rates and no marked flocculating tendencies. On the other hand, in the samples collected from the control area the material causing turbidity was, except in one or two instances, almost entirely organic in composition. It exhibited a definite flocculating characteristic, and the floc settled rapidly.

Discussions and Conclusions

Correction of the deficiencies described would go a long way toward ameliorating the destructiveness of most logging operations in the southern Highlands. First, considerably more attention should be given to the location and grade of access roads. For instance, on Watershed No. 10, the road is so laid out that slopes as high as 28 per cent alternate with relatively flat stretches. Erosion on the steep sections is much harder to control because of the increased velocity and erosive force of the flowing water. Also, because of these steep slopes the road is highly dangerous in wet weather and in many cases impassible to truck traffic. In laying out the road the location of the valuable trees and stands and wood forest products should be well known in relation to each other so that the least amount of road necessary to remove these forest products has to be constructed. In other words, the road layout should be designed. An important factor involved here is the length of time of the operation. It is not only important to the timber operator, but also

extremely important to the watershed manager since turbidities and soil losses are increased proportionately. In many cases where a proposed timber sale or removal contract is supposed to be completed in a year, it is still going at the end of 2, 3, or 4 years. Further exploitation for other forest products very often lengthens the time that the road is in use. Thus the widely-held opinion that the sale will be consummated in a short time and that the damaging effects of the road or roads can be rectified following the operation is false. It is false also because, as has been pointed out, the greatest erosion, transportation of sediment, and resulting high turbidities occur while the actual logging is in progress on the watershed.

Secondly, the matter of road drainage can hardly be over emphasized. The motto of the military road builders is "Keep the water off and the rock on." The first part of this maxim definitely applies to the construction of logging roads. Since the roads are generally unsurfaced, the ever-present wheel ruts nullify the use of crowning or sloping the road surface for drainage. The ruts concentrate water and are frequently sources of serious erosion. This means that water bars or turnouts are almost invariably necessary in order to overcome the erosive concentraton of water. Experience at Coweeta has shown that an open top culvert made of sawn timbers and pipe spacers has been entirely satisfactory for this purpose. However, more information about the design and installation of these water bars is needed.

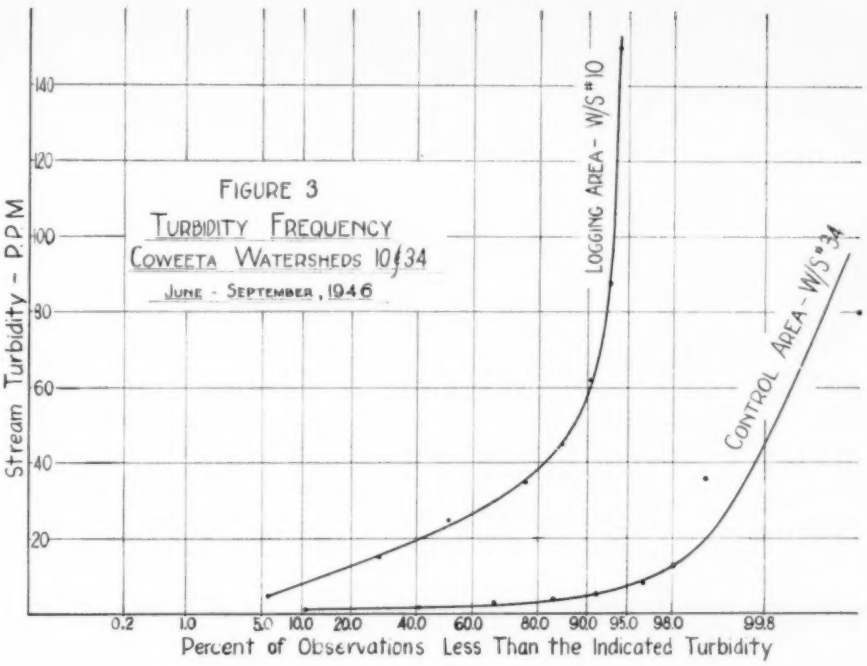


Fig. 3—Turbidity Frequency of Streams from Controlled and Logged Watersheds.

Track laying equipment and winches are valuable aids in any logging operation. These, however, must be used with the watershed values kept well in mind, because their promiscuous use can very often result in conditions extremely conducive to erosion. The careful use of arches, sulkies, pans, cable systems and other equipment may do much to eliminate or reduce destructive erosion and sources of turbidities.

Other items, such as location of skid trails to avoid both the concentration of skidding and the formation of gullies, also deserves thought and attention.

Ultimately, the problems and their solutions are related to economic considerations. The complications of logging contracting, sub-contracting, and sub-sub-contracting divide and obscure responsibility. In such a situation no one feels responsible for the preservation of water values. A complete discussion of these considerations is somewhat beyond the scope of this article. In almost all cases, however, the economic problems resolve themselves into one of possible increased initial capital investment versus much higher maintenance costs. Experience has clearly indicated that a properly regulated and operated logging job, while it may require higher initial outlay of capital, results in lower maintenance cost in the final analysis and a more efficient and profitable operation. In addition, the properly operated job which abides by known and demonstrated principles of watershed management maintains the water resource of the watershed. This is of utmost importance in connection with municipal and industrial watershed management.

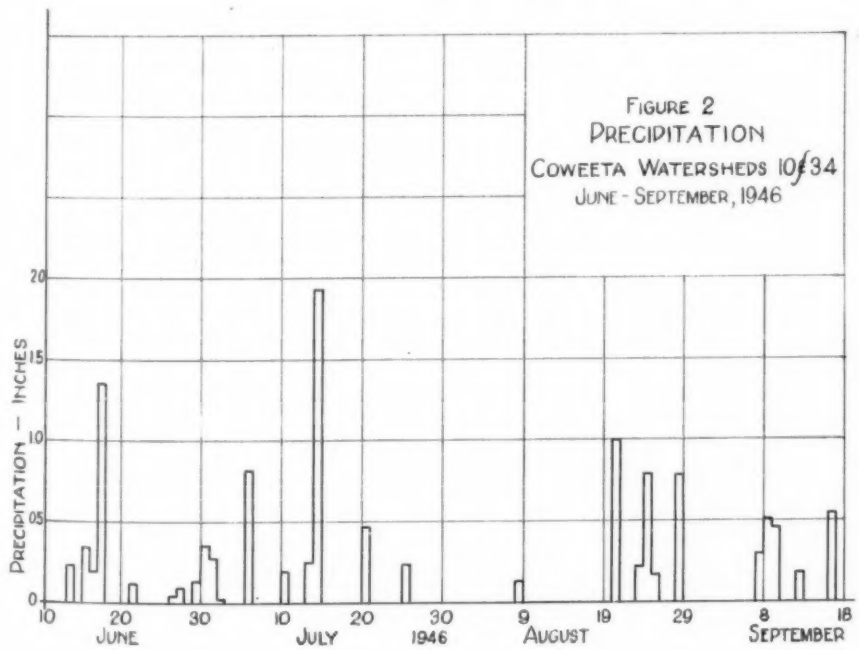


Fig. 2—Precipitation Record for the Two Watersheds.

Summary

For the most part, the difficulties of harvesting wood products from areas of high watershed values center around the general problem of transporting the forest products out of the watershed onto main roads.

The general problem may be broken down into three sub-problems connected with:

1. Location and design of access road and skid trails.
2. Use of heavy building and logging equipment.
3. Road maintenance.

We believe that the correction of known deficiencies will reduce the turbidity associated with the common uncontrolled logging operation and also improve the overall efficiency of the operation itself. In order to test this on a practical basis, another experimental watershed of some 300 acres will be logged using the best existing knowledge. Similar quantitative measurements will be taken on the area.

These studies are a part of the research at the Coweeta Hydrologic Laboratory to determine adequate bases for the utilization of water source areas for public water supply, timber production, recreation and other compatible uses.

References

(1) Wolman, Abel; Green, Carl E.; and Grondal, Bror L. "Report on the Water Supply and the Cedar River Watershed of the City of Seattle, Washington." Seattle, February, 1944.

(2) Lieberman, J. A., "Water Resource and Watershed Management Research in the Southeast," *Jour. Am. Water Works Assoc.* 39:5, May, 1947.

(3) Thornthwaite, C. W., "The Moisture Factor in Climate," Trans. Am. Geophys. Union 27:41 (Feb., 1946).

(4) Hoover, Marvin D., "Effect of Removal of Forest Vegetation Upon Water Yields," Trans. Am. Geophys. Union, Part VI: 969 (1944).

FEDERATION DETROIT PROGRAM SHAPES UP

The program for the 21st Annual Meeting of the Federation of Sewage Works Assns. is complete and it is expected that this meeting to be held on Oct. 18-21 will attract the largest registration yet to attend a Federation Meeting.

The Michigan Sewage Works Assn. will act as host at the Detroit meeting, with W. W. Wallace, Supt. of Filtr. and Sew. Treat. acting as Chairman of Arrangements.

The meeting will be held at the Hotel Statler which is prepared to accommodate 600 registrants. Hotel reservations should be made immediately, directly to the hotel, *not* to the Federation. In making reservations mention that you are attending the Federation Meeting. If you prefer, reservations may also be made at the Book-Cadillac Hotel which is but a block away from the Statler.

Technical Program

The complete program for the meeting will be given in the next issue of *Water & Sewage Works*. For this preliminary announcement it is sufficient to say that the program will have a broad general appeal. Among the topics of interest are papers on Activated Sludge, Atomic Wastes, Synthetic Detergents, Hydrogen Sulfide Formation, Biology of Sewage Treatment, Sewer Maintenance, and Bio-Precipitation. One session will be devoted to an Industrial Waste Forum, another to an Operators' Forum. Dr. F. W. Mohlman, Dir. of Labs., Chicago Sanitary District, will conduct the former, and Ralph Fuhrman, Supt. of Sew. Treat., Washington, D.C., will conduct the latter.

Features of the meeting include an inspection trip of the Detroit and Dearborn Sewage Treatment Plants, and the annual luncheon will be addressed by Kenneth A. Reid, Exec. Dir. of the Izaac Walton League of America.

Exhibits and Social Program

Thirty-six member companies of the Water and Sewage Works Manufacturers' Assn. have reserved space to exhibit at the meeting in Detroit. Full occupation of the exhibit area is assured.

Social events will include a Reception Entertainment on Monday evening, Oct. 17, and the Annual Dinner and Dance on Wednesday evening, Oct. 19.

"Pay-as-You-Use" Scheme Meets Court Test

One hears more and more of the "rent-purchase" form of contract in the purchase of equipment by municipalities. This "pay - as - you - use" scheme of paying for equipment without recourse to a bond issue or other methods of borrowing for purchases has been held valid by the Supreme Court of Florida.

The case in point is that of Jacksonville, Fla., which is contracting with the Nichols Engineering and Research Corp. for the construction of two incinerators, wherein their cost will be paid in the form of an annual rental of $31,000. After 15 years of such annual payments the incinerators will become the property of the city. The contract also permits the city to complete the purchase of the incinerators at *any* time for the fixed price of $381,000—full credit for the rental paid up to purchase time being allowed.

The interesting aspect of this type of purchasing contract insures to the city units which prove satisfactory in all respects and meet every guarantee of the renter-seller. As a matter of fact the Jacksonville incinerators will have been operated more than 6 years before the city has a 50% equity in these important punishment taking units.

For the first time to our knowledge a court has decided that it is legal for a municipality to purchase equipment on a partial payment plan—call it what you may. Better than a partial payment plan, the "rental-purchase" method of buying equipment in no-wise commits the city authorities to completion of the purchase should developments warrant discontinuance of the rental payments.

WATER PURIFICATION DIVISION HOLDS THREE SESSIONS

A Report by
HARRY A. FABER*
Editorial Associate

At the 68th Annual Conference of the American Water Works Association in Atlantic City, May 3-7, the Water Purification Division held three sessions with Charles R. Cox as Chairman of the Division. The Co-Chairman and the Associate Presiding Officer at each of these sessions were: R. J. LaMarre and G. R. Spalding, first session; C. J. Lauter and J. L. Radcliffe, second session; and I. M. Glace and George D. Norcom, third session.

Two technical papers and a panel discussion comprised the program of the first session; the second session was devoted to three papers on the cultivation and identification of "nuisance" organisms; and the third was a business session at which various committee reports were presented.

Rather unusual circumstances required the election of three officers of the Water Purification Division at this time. The resignation of A. P. Black and C. M. Hoskinson, Directors, and the deeply regretted death of C. K. Calvert made it necessary to elect two new Directors at one time. The nominating committee recommended the following slate of officers who were unanimously elected:

Chairman
I. M. Glace, Cons. Engr., Harrisburg, Pa.

Vice-Chairman
R. L. Derby, Ass't. San. Engr., Dept. of Water and Power, Los Angeles.

Secretary-Treasurer
J. E. Kerslake, Supt. of Filtration, Water Purif. Div., Milwaukee, Wis.

Directors
H. E. Hudson, Jr., Engineer, Ill. State Water Survey, Champaign, Ill.
H. E. Lordley, Plant Manager, Dept. Public Utilities, Richmond, Va.
C. R. Cox, Bureau Chief, State Dept. Health, Albany, N.Y. (ex-officio)

TECHNICAL PAPERS

"Short Period Flocculation and Clarification Basins," by R. W. Haywood, Jr., Asst. to Div. Engr., San. Div., American Viscose Corp., Philadelphia, Pa., and C. F. Wertz, Resident Engr., Dept. of Water and Sewers, Miami, Fla.

Operating results in using this relatively new method of clarification were emphasized by both Messrs. Haywood and Wertz in entirely separate papers of this title. Mr. Haywood described experience with Spaulding "Precipitators," rectangular in shape, installed in a gravity filter plant. Filter rates are automatically adjusted by the level of water existing in the plant clear well; in turn, this automatic adjustment varies the rate of operation in the Precipitators. Raw water dosed with chemicals is applied through a center flume, and enters the basins at the bottom. Floc particles form a blanket of sludge which clarifies the rising water. These Precipitators are provided with perforated pipes through which water is discharged under pressure to stir solids and facilitate the withdrawal of sludge.

Operating difficulties were attributed mainly to the provision of a clear well of inadequate capacity which could not absorb and smooth out variations in rate of flow. When changes in rate were gradual, excellent operation of these basins resulted; when changes in rate were rapid, poor clarification resulted and turbidity of the clarified water was high. Mr. Haywood described remedial procedures, and the improved operations which resulted from their application. He concluded that the results obtainable with these short period units compare favorably with older standard rate units, and that the new equipment represents a forward step providing its limitations are recognized.

The paper prepared by Mr. Wertz was read by C. R. Henry of the Miami Municipal Water Works. Short period basins are to be used in the new Miami Water Treatment Plant, for which plans are now about 50% completed. Preliminary investigation of three types of units indicated results on a par with standard rate units. Studies showed a large increase in alum dosage (six times normal) improved the results, and that the use of sodium silicate accomplished a remarkable improvement. The benefits therefrom have already led to plant scale use of silicates in several Florida water treatment plants.

Mr. Wertz described design features and operating results at several plants in the U. S. where short period basins are in use. The main operating difficulty, and one requiring constant attention, is reported to be that of maintaining the desired level of the sludge blanket. When the unit operates at less than design capacity, or when silicate is used as a floc conditioning agent, this difficulty can be generally overcome.

The author's conclusions emphasized that either short period basins or the older settling basins can yield about the same results in turbidity removal. The construction cost of

Purification Division Officers

I. M. Glace
Harrisburg, Pa.
(New Chairman)

C. R. Cox
Albany, N.Y.
(Past.-Chm'n)

J. E. Kerslake
Milwaukee, Wis.
(Secretary)

H. E. Lordley
Richmond, Va.
(Director)

H. E. Hudson
Champaign, Ill.
(Director)

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

short period basins will be lower, and so may the cost of chemical treatment. The rate at which a given unit operates (in gal. per sq. ft. of water surface per min.) is a function of the particular water treated and of the conditioning chemicals applied. Generally, higher operating skill is required by the short period basins.

Prepared discussion of these two papers was presented by H. O. HARTUNG, Plant Engineer, St. Louis County Water Co., St. Louis, Mo., and by S. B. APPLEBAUM, Pres., Liquid Conditioning Corp., Linden, N.J.

Mr. Hartung summarized present opinion with reference to short period units, as based on replies to a questionnaire sent by the Water Purification Division Committee W-4 (Practical Loading Capacities of Water Treatment Plants), of which he is Chairman. These replies are considered by the Committee to be significant as opinion only.

There appears to be general agreement on these items: Rates in about 60 per cent of the operating units appear to be as high as design rates. The degree of clarification accomplished appears to be at least as good as that in conventional units. The short period basins are satisfactory for treating turbid water supplies. On the average, the chemical dosage required is about the same for either type of unit. More operating failures are reported for the short period units. There are no State Dept. of Health rules or regulations regarding the installation of such units in 32 states, while 15 states discourage or (in some cases) limit their use.

Mr. Applebaum, speaking as a representative of those manufacturing short period units, noted that the limited number of technical papers on this subject is probably explained by the fact that the greatest number of installations have been made in industrial rather than in municipal water treatment plants. He prefers the term "sludge contact reactors" as better explaining the function of these units. By means of lantern slides, Mr. Applebaum described the operation of the various commercial units. Among operating improvements in this field, he mentioned: automatic control of sludge level and automatic desludging, in proportion to chemical feed—that is, adjusting sludge removal to floc formation.

In the open discussion which followed, L. H. ENSLOW (New York City) asked the value of recirculating sludge as a coagulant aid in connection with these short period precipitators; WM. YEGEN (Bismarck, N.D.) questioned the effect of rapid temperature changes; PAUL STEGMAN (Midland, Mich.) commented on conditions which may enable short period basins to yield far superior results; A. F. MELLON (Minneapolis, Minn.) pointed out that nature aids at times of low water temperature by lowering turbidity at the same time; D. J. SAUNDERS (New York City) discussed an "electric eye" device to measure turbidity as an aid to operation; and C. J. LAUTER (Washington, D.C.) advocated superchlorination for pretreatment as an aid to coagulation for both conventional and short period clarification.

"THE OPERATION AND CONTROL OF SMALL WATER TREATMENT PLANTS," by Thomas R. Lathrop, Asst. Engr., State Dept. of Health, Columbus, Ohio.

Mr. Lathrop included the problems of design, operation, and personnel among those of special importance in small plants, but considered the factor of design to be outstanding. In addition, special difficulties are encountered if a water softening process is included.

Differentiating between surface water and ground water supplies, Mr. Lathrop noted that his state requires the provision of 4 hours' detention in coagulation of surface waters but may permit less for softening of ground waters; filtration rates must be no more than 2 gal. per sq. ft. per min. for surface water, but may be 3 gal. for softening and iron removal plants treating ground water. All filters must be equipped with rate controllers. In this discussion, a small plant is defined as that treating 500,000 gpd. or less.

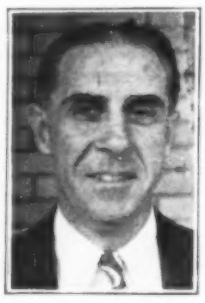
The list of the more important design deficiencies in small plants includes: inadequate storage space for chemicals; improper mixing facilities; chemical feeding equipment not suited to low rate operation (solution feed is generally preferable in small plants); and lack of surface wash equipment (this provision is frequently a successful "homemade" addition). Pressure filters are discouraged. In small softening plants, recarbonation presents problems—but the recent development of units employing dry ice as a source of CO_2 represents a marked advance, and excellent results are reported in their use.

Among operating problems, the development of algae in open reservoirs is outstanding. Copper sulfate is generally employed on a regular treatment schedule; when this is not effective the plant consultant is called in to advise. Maintenance problems involve chemical mixing units and filter units (especially in softening plants). The high-test hypochlorites are recommended as more suitable for chlorination in small plants.

Personnel problems are really serious: the salary paid is often insufficient for providing a full-time operator, yet he has many jobs in addition —such as making chemical and bacteriological tests. In Ohio, the size of the plant and the character of the raw water determines operator requirements: when surface water is treated, the plant operator must have an A or B certification. Short schools for operator training are now being established by the State Health Dept.

Discussors of Performance of Short Period Clarification Basins

R. W. Haywood
Sanitary Engr.
Am. Viscose Corp.
Philadelphia



C. F. Wertz
Engineer
Dep't. W. & S.
Miami

S. B. Applebaum
President
Liquid Cond. Corp.
Linden, N.J.

H. O. Hartung
Ch. Chemist
St. L. Co. Water Co.
St. Louis

D. J. Saunders
Mg'r. of Sales
The Permutit Co.
New York

In reply to a question from R. J. Faust (Lansing, Mich.) Mr. Lathrop reported lime softening sludge to be generally removed by farmers for its lime content. To N. J. Howard (Toronto, Can.), who decried politics in water treatment, he explained that no political problem existed in Ohio

Programmers

T. R. Lathrop
San. Engr.
Ohio Dep't. Hlth.
Columbus

R. G. Yaxley
Sup't.
Water Comm.
Waterford, N.Y.

plants; the problems are largely related to the provision of adequate equipment. A small plant operator, R. G. Yaxley (Waterford, N.Y.), agreed that highly accurate chemical feeding equipment is particularly necessary in small plants, but that the price of such devices is a stumbling block frequently.

WATER BORNE OUTBREAKS

(A Panel Discussion)

"Water Borne Outbreaks 1938-1945—Panel Discussion," Led by Rolf Eliassen, Prof. of San. Eng., New York University, New York City.

Instances of water treatment failure which have resulted in outbreaks of water borne disease are included in the voluminous record of a hearing on "Stream Pollution Control." The hearing was a part of the program to secure legislation toward Federal control of pollution.

Professor Eliassen noted that the water supply industry could fairly evaluate control of water borne outbreaks on the basis of per cent failure or per cent success. In the period 1938-1945, some 80 million consumers were supplied with water. The eight year record shows 100,000 consumer days of disease, or indicated that water treatment was successful 99.99996% of the time. In spite of this excellent record, however, the industry must examine its failures.

The detailed analysis of the data, classification of factors involved, etc., is to be published in an early issue of the AWWA Journal and will probably be available before this report is printed. In summary, it will be noted only that none of the outbreaks could be attributed to any inherent inability of water treatment processes to handle the load imposed upon them. That is, these outbreaks were not a matter of stream pollution, but were concerned with personnel failure to properly control filtration or chlorination treatment.

J. E. Kerslake, Supt. of Filtration, Milwaukee, Wisc., (Panel Member) discussed the Milwaukee outbreak. This occurred before the filtration plant was installed, when simple chlorination with 10 min. contact constituted the only treatment. Rapid changes in coliform content are normal for this lake supply, and the city now provides free residual chlorination in addition to filtration.

I. M. Glace, Cons. Engr., Harrisburg, Pa., (Panel Member) pointed out that operators of small water treatment plants are usually more fortunate than expert in preventing water borne disease. He emphasized the need for educating public officials who are in position to make the operators' profession more attractive to qualified men.

A. P. Black, Prof. of Chemistry, University of Florida, Gainesville (Panel Member) called attention to our "twilight zone of knowledge." He questioned the statement that toxins cannot cause outbreaks of water borne disease. It is possible that such substances may have a profound physiological effect, and their removal by present water treatment processes is problematical. He considers that the disinfection of all public and private water supplies should be mandatory.

Charles R. Cox, Chief, Bureau of Water Supply, State Dept. of Health, Albany, N.Y., (Panel Member) quoted the reduction in number of typhoid carriers as perhaps the most effective factor in our present favorable typhoid fever death rate. He considers this a transition period in which not only improved control and operation are needed, but in which new knowledge is also required. One such study is under way in New York State: epidemics of gastroenteritis are frequently accompanied by bacilliary dysentery, and the virus associated with the dysentery is being investigated. Such epidemics have been accompanied by great increases in chlorine demand of the water. It appears that adequate chlorination will destroy the virus.

This panel discussion evoked considerable comment from the audience, the speakers including: L. M. Fisher, U. S. Public Health Service, Washington, D.C.; S. W. Wells, State Board of Health, Jacksonville, Fla.; R. J. Faust, State Dept. of Health, Lansing, Mich.; and E. A. Reinke, Chief, Bureau Sanitary Engineering, Berkeley, Calif.

"NUISANCE ORGANISMS"

(A Symposium)

"The Cultivation and Identification of 'Nuisance Organisms'" was the title of a symposium of unusual interest. The three specialized papers presented under this title comprised the Division's 2nd session.

"Slime Forming Organisms," by F. B. Strandskov, Bacteriologist, Research Dept., Wallace and Tiernan Co., Newark, N.J.

A large variety of non-pathogenic organisms have a normal tendency to produce slime, capsules, or sheaths. The adhesive and accumulating properties of this material makes it of particular importance in condenser systems, paper mills, food processing plants, etc.

Mr. Strandskov explained that slime production is probably a normal function of all species of bacteria under certain conditions. Low incubation temperatures, the presence of a readily-fermentable carbohydrate, and mixed cultures, may provide such conditions. It is difficult, however, to provide laboratory conditions duplicating those under which slimes are produced in the field. Direct microscopic examination of slimes is more useful than culture procedures. A wet mount is first examined under low magnification, and then a stained (gram stain) smear is studied under high magnification.

Most useful is the capsule stain technique: slime and india ink are spread in a thin film, and the film is treated with alcoholic safranin. By this procedure, the bacteria stain red, the capsular material appears as a clear

Programmers

Rolf. Eliassen
Professor
N. Y. University
New York

A. P. Black
Professor
Univ. of Fla.
Gainesville

area surrounding the bacterial cells, and the background is black.

Of the other slime forming organisms, algae are determined by Sedgwick-Rafter filtration or by continuous centrifuging; molds can be easily cultivated on nutrient agar which is enriched with dextrose and adjusted

to pH 4.5 to 5.0. The bacterial counts on standard agar, however, provide an index of the presence or absence of slime forming organisms.

"SULFATE REDUCING ORGANISMS," by R. L. Starkey, Research Specialist —Microbiology, New Jersey Agri. Experiment Sta., New Brunswick, N.J.

Committee Chairmen

J. C. Vaughn
Filtration Engr.
Chicago

D. E. Davis
Chester Engrs.
Pittsburgh

Dr. Starkey described briefly the transformation of elemental sulfur and of sulfur compounds which are brought about by many microorganisms. Only the sulfate reducing bacteria, however, appear to cause the direct reduction of sulfate to sulfide. Sulfide production makes water unpalatable and odiferous and may result in the corrosion of steel and cast iron water distribution systems. These organisms are widely distributed in soils, particularly where anaerobic conditions exist, as in marshes, muds, and marine sediments.

The sulfate reducing bacteria are strict anaerobes. They are physiologically unique, using organic matter as the source of growth energy and requiring sulfate or incompletely oxidized sulfur compounds as oxidizing agents. The organic matter is oxidized and the sulfates are reduced to sulfide. *Spirovibrio desulfuricans* is the most common of such organisms. It develops under conditions of pH 5.5 to 8.5. All species of sulfate reducing bacteria are curved rods in shape.

Many bacteria, yeasts, and filamentous fungi can also produce sulfide from organic and inorganic sulfur compounds, but this is an "indirect reduction," a part of the life process. Dr. Starkey described in detail the anaerobic cultivation methods employed for growing sulfate reducing bacteria. His comprehensive paper represents a valuable contribution to water works and sewerage literature.

"IRON BACTERIA," by George D. Norcom, Consultant, Red Bank, N.J.

Mr. Norcom reviewed the relationship of iron bacteria to water supply, discussing their occurrence in nature and noting that they utilize organic matter for sustenance. They may be found in waters having an iron content as low as 0.1 ppm. but may not be found in waters containing as much as 6 or 7 ppm. iron. These bacteria are generally classified as of two types: (1) "higher bacteria," filamentous forms, and (2) "lower bacteria," spheres or rods.

The characteristics of *Crenothrix, Leptothrix, Gallionella, Spirophyllum, Colonothrix,* and *Cladothrix,* common higher bacteria, and *Siderocapsa,* an abundant lower bacteria, were described. Both types precipitate iron from solution and exude the hydrate through their cell walls. Fungi may be mistaken for iron bacteria, but may be differentiated on the basis of the size of the organisms and because the fungi reproduce by budding.

The presence of iron bacteria in a water supply is revealed by material which may range from small gray or brownish flakes to large masses of stringy or fluffy growths; and by an odor of decay. The most generally satisfactory method of concentrating such bacteria for examination is to store a one gallon sample of the water for a week or more at room temperature. Iron bacteria will collect in a fuzzy mass which settles with the precipitated ferric hydrate. Artificial cultivation is difficult and usually only direct microscopic observation need be made.

Chlorination is the most successful method found to reduce or eliminate the development of these bacteria. Tuberculation may be chemical or biological in nature, but iron bacteria certainly thrive in tubercules and contribute to further corrosion. While chlorine-ammonia treatment is reported effective as a control measure, "break-point" or super- and dechlorination is considered more effective as a preventive treatment.

Questions from the audience indicated the wide interest in the subject of this symposium. These three papers will, when published, provide useful information on a rather neglected field of investigation. It was noted, for example, that over 50 per cent of the 850 water supplies in New York State would be affected by one or more of these "nuisance" organisms.

COMMITTEE REPORTS

As an introduction to the several committee reports presented at the Division's third session Chairman Cox emphasized the value of committee functions and of the contributions which result. He stated that the importance of this work is seldom appreciated, and felt that some means should be found to give recognition to members who make such contributions.

A report on "BIOLOGICAL AND CHEMICAL PROBLEMS OF WATER DISTRIBUTION SYSTEMS" was presented by J. C. Vaughn, Filt. Engr., Chicago, Ill., Chairman of this committee.

It is the purpose of this committee to determine why, when water of good quality is discharged into a distribution system, the water frequently depreciates to a less favorable condition. The distribution system must, apparently, be considered to be a part of the purification plant. When the causes of water quality depreciation are determined, it can be learned what correctives are required.

Representatives of eleven water supplies are already participating in the study, and the cooperation of several more was arranged during the meeting. The Committee has selected some 20 important tests, to be applied to samples taken part of the distance through and at the end of a distribution system. Bacterial depreciation is considered first in importance, and chemical stability tests follow. One such survey is made each month on each supply being studied. It is intended to have the tests assist particularly in explaining water borne outbreaks not ordinarily understood. There is, as yet, insufficient data to draw conclusions, and new techniques may be required as the work progresses.

A report on "SPECIFICATIONS FOR AND METHODS OF TESTING ZEOLITES" was presented by the Chairman of this Committee, D. E. Davis, Partner, The Chester Engineers, Pittsburgh, Pa.

This is the final report of the Committee, and Mr. Davis gave assurance that ion exchange materials can be suitably tested by the detailed procedure now recommended. While

Committee Chairmen

Richard Hazen
Pirnie Eng'rs.
New York

N. J. Howard
Sup't. Purification
Toronto

some controversial items are still present, they are covered in the research section of the report. Final acceptance of the report is recommended, and the Committee asks to be discharged.

It has not been possible to determine the length of life of ion exchang-

ers in plant practice. Certain newly developed exchangers may be susceptible to "poisoning" by free available chlorine in the water. It is considered likely that even newer and more efficient exchangers may be developed, and an increased use in the municipal water treatment field is predicted.

A report on "SPECIFICATIONS FOR FILTERING MATERIALS," also a final report, was presented by the Chairman of this Committee, Richard Hazen, of Malcom Pirnie Engineers, New York, N.Y.

Two years of work is represented by the report now submitted, and it is offered as a tentative standard for the present. Difficulty has been experienced in reaching a unanimous agreement on several items—the matter of sand sizes is one example of this. The Committee considers sand and gravel used under these standards will give satisfactory results. Specifications for anthracite coal, as filtering material, are provided in the appendix of the report.

A progress report on "OPEN AIR RESERVOIRS" was presented by the Committee Chairman, Norman J. Howard, Director of Water Purification, Toronto, Ont.

Mr. Howard's committee has sent questionnaires to state and provincial health authorities to determine practice, experience, and opinion concerning the open air distribution reservoir. Mr. Howard read and discussed the replies to this questionnaire, as he had presented them at the San Francisco meeting, and enlarged upon the subject.

The conclusion appears to be that all distribution reservoirs should be covered; if this cannot be done, the water leaving the reservoir should be chlorinated. Sufficient comparative tests of water entering and leaving reservoirs have not been made. A preliminary report has been prepared and circulated in order to provide an opportunity for review.

Harry A. Faber
Res. Chemist
The Chlorine Inst.
New York

Gordon M. Fair
Dean of Engr.
Harvard Univ.
Cambridge

In discussing this subject, W. M. WALLACE, Detroit, described how even elevated storage tanks have been contaminated by swimmers. B. C. NESIN, New York City, noted that terminal chlorination of all secondary reservoirs of the New York supply was instituted as a war time measure; extensive coliform contamination of these reservoirs results from the presence of bird life; taste and odor conditions, and temperature changes complicate the chlorination problem, but a program of upstream chlorination is now being developed for the entire system. C. J. LAUTER, Washington, D.C., said the covering of reservoirs does not provide a complete answer: circulation or displacement of water is very important and, where this is not provided, the level of reservoirs which merely float on the system must be varied.

A progress report on "THE JOINT EDITORIAL BOARD FOR STANDARD METHODS," was presented by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York.

The next edition of *"Standard Methods for the Analysis of Water and Sewage"* is to be a joint enterprise of the A.P.H.A., the F.S.W.A., and the A.W.W.A. Each association has appointed one representative to serve on a Joint Editorial Board which is authorized to prepare the 10th edition. These representatives are McCrady of Montreal (A.P.H.A.), Hatfield of Decatur (F.S.W.A.), and Faber of New York (A.W.W.A.)

A Water Purification Division Committee on Standard Methods has only recently been established to take part in the preparation of the new edition. Mr. Faber explained that a formal meeting of the Joint Editorial Board has not yet been held and that plans are still in a preliminary stage. In addition to the new Committee, the cooperation of all Division members will be needed in order to advance the work of the Board. More specific aims and plans will be announced later this year.

40 YEARS OF CHLORINATION

Few may realize that the chlorination of public water supplies is 40 years old.

AWWA gave special recognition to the fortieth anniversary of water chlorination by arranging a symposium of four related papers on this subject. This session was under the chairmanship of L. H. Enslow, the new President of the Association, who made many contributions to this field, particularly through his activities with the Maryland and Virginia State Health Departments, as Research Engineer of the Chlorine Institute, and as editor of *Water and Sewage Works*. The Co-Chairman was H. M. Ohland, Hydraulic Engineer of the Water Department of Jersey City (the first U. S. municipality to have a chlorinated water supply). Mr. Enslow called attention to the good fortune of the Association in having, as the first speakers, two of the men who were instrumental in the introduction and development of this important and effective water treatment practice.

Advanced Chlorination

M. F. Tiernan
President
W. & T. Co.
Newark, N.J.

L. H. Enslow
Advisor
The Chlorine Inst.
New York

"THE FIRST STEP — CHICAGO, 1908," by C. A. Jennings, Mishawaka, Ind.

Mr. Jennings described developments which led to the earliest application of chlorinated lime for the disinfection of a water supply—that at the Bubbly Creek filtration plant of the Union Stockyards in Chicago. His first job, as a young chemist employed by the producers of copperas (ferrous sulfate), was to develop the use of this product, with lime, as a water coagulant. He succeeded in producing a clear water from the grossly polluted Bubbly Creek by coagulation and filtration.

As a result of his pilot studies, a 5 mgd. filtration plant was built to supply water for cattle and other livestock, and Mr. Jennings was employed to operate it. The plant operated very successfully, but the finished water had a high bacterial content. On the recommendation of George A. Johnson, Consulting Engineer, the addition of chlorinated lime (20 to 35 lb. per m. g.) was investigated. The official test of this new method of treatment, on September 3 to 17, 1908, resulted in the acceptance of the plant.

Mr. Jennings recalled that the City of Chicago considered the Bubbly Creek filtered and chlorinated water a health hazard. The City took the view that while this plant was operated to provide water of adequate volume and pressure for use in the stockyard (to water cattle and provide a fire supply), the water might be consumed by men employed there, and might also infect the meat from the

cattle using it. A lawsuit was instituted, extended hearings were held, and over 1,000 pages of testimony were taken; but permission was given for continued use of the supply.

This demonstrated success of chlorination for disinfection led, of course, to its application at Jersey City, N.J., by Johnson and Leal in treatment of the first chlorinated municipal supply later in the same year. Early in 1910, Mr. Jennings was given leave of absence to install a chloride of lime treatment plant for the City of Erie, Pa., where a typhoid fever epidemic had occurred. Similar installations were made by him shortly thereafter for cities in Washington, Oregon, Iowa and Indiana. Following the introduction of equipment to utilize chlorine gas, he became a district representative for Wallace and Tiernan Co., serving in that capacity for many years.

"Controlling the Green Goddess," by M. F. Tiernan, President, Wallace and Tiernan Co., Inc., Newark, N.J.

Mr. Tiernan spoke informally, describing the early years and the early problems in developing chlorine-gas feed devices for water treatment. In 1909, he met Wallace while both were employed in New York City by a firm manufacturing ozone equipment.

When "Fred" Wallace and "Mike" Tiernan set up their own organization ("to manufacture any equipment for which they could find a market"), they learned of the chlorine-gas feeding device being experimented with by Major Darnall of the Army at Fort Myer, Va. In the U. S., the production of liquid chlorine had just been started by the Electro-Bleaching Gas Co. In his original work, Darnall had used a cylinder of chlorine imported from Germany. Dr. Ornstein of the EBG Co. learned of the Darnall application and in June of 1912, produced equipment to apply the new form of chlorine to water.

Wallace and Tiernan made the first installation of their simple but efficient chlorinator at Dover, N.J., on February 22, 1913. Less than one month later they designed, produced, and installed (at Torrington, Conn.) what they termed their first "Automatic Chlorinator"! Shortly thereafter W & T equipment was installed to chlorinate water supplies of Jersey City, Newark, and New York City.

Mr. Tiernan reviewed the many improvements which have developed over the years in the design and operation of chlorinators, up to the present complex equipment which employs amperometric control of chlorination. He considers a great field of opportunity still open for future developments and for higher standards of efficiency; there are probably twenty-five thousand to thirty thousand chlorinators now in operation. The teamwork and pleasant relations which exist among those who make and use chlorinators to "Control the Green Goddess" are regarded by Mr. Tiernan as a happy reward for forty years of work.

"Pioneers in the Development of Chlorination," by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York, N.Y.

The history of the development of water chlorination is, essentially, the story of the pioneers—bacteriologists, chemists, engineers, business men, and operators—who first took an idea and made it work. Mr. Faber described briefly what these men did and, by means of lantern slides, showed how these men looked when they made their contributions to this young science. His paper, to be published in the AWWA *Journal*, will include the photographs of practically all of the pioneers.

He called attention to Chester Averill, a young professor of chemistry at Union College who in 1832 was perhaps the first American writer to mention the disinfecting power of chlorine. William M. Jewell used chlorine gas (for a few days in 1896) to disinfect water on plant scale at Louisville, Ky. The United States was not the first country to use chlorine for continuous treatment of water; credit for the first adoption of this treatment belongs to M. Duyk (1902) of Middle Kirk, Belgium, and, for the second, to Sir Alexander Houston, who in 1905 chlorinated one of London's water supplies as an emergency measure.

Mr. Faber dated the inception of chlorination in North America from Mr. Jennings' work at Bubbly Creek and from the chlorination of the Boonton supply of Jersey City (in 1908). He commented on the first chlorinator devised by Darnall (in 1911) and the commercial equipment marketed by Wallace and Tiernan (in 1913). Once the equipment had been provided, the contributions of Phelps, Ellms and Hauser, Wolman and Enslow, and others made it possible to properly control chlorination treatment.

Among those who began the refinement of water chlorination, the work of Race, Howard, McAmis, and Scott was described. Today, forty years after the beginning of this practice, chlorination is still in a state of development. Great credit, however, should be given to those pioneers who explored to the point from which further advance is possible.

"Chlorine as a Water Treatment Material," by Gordon M. Fair, Dean, Graduate School of Engineering, Harvard Univ., Cambridge, Mass.

Professor Fair commented on our extensive practical experience with chlorine for the disinfection of municipal water supplies, but called attention to our lack of fundamental knowledge of its chemical and biological action. In this paper, he described recent advances toward understanding these reactions, and he indicated some of the unexplored areas of its behavior.

The hydrolysis of chlorine in water (virtually complete in the low concentrations ordinarily employed for disinfection) produces hypochlorous acid, and this product exerts the major disinfecting actions. This acid ionizes and the ionization constant, K, depends only on the temperature of the water. The relative amounts of hypochlorous acid and its ionization products, hydrogen ions and hypochlorite ions, in a solution of so-called "free chlorine" are a function of the pH value of the solution.

An illustration was employed to show that the percentage of "free chlorine," as undissociated hypochlorous acid (at 20° C.), varies from 100% at pH 4, to only 0.3% at pH 10. It illustrated also that to provide 1 ppm. of hypochlorous acid at pH 4 required 1 ppm. "free chlorine," 1.33 ppm. at pH 7, 4.3 ppm. at pH 8, 34 ppm. at pH 9, and 331 ppm. at pH 10. This data revealed the disinfecting action of such solutions to be strikingly affected by the pH value. Chloramine formation, of course, further modifies the disinfecting power of chlorine. The maximum rate of "break-point" reactions has been found, in the Harvard studies, to occur at about pH 7.5.

Discussing the biological reactions of chlorine, Prof. Fair noted all research on this subject to be quite recent. A satisfactory explanation of bactericidal action is provided by assuming hypochlorous acid to react on the enzyme necessary for utilizing glucose within the bacterial cell. He discussed in detail those factors known to affect the efficiency of disinfection. There is a real need for further and intensified research into the chemistry and biology of water chlorination.

CLEVELAND'S NEW WATER INTAKE

3½ Mile Section Being Constructed of 10 ft. Concrete Pipe

by
FRANK J. SCHWEMLER
Construction Engineer
DEPT. OF PUBLIC UTILITIES, CLEVELAND, OHIO

WITH the whole of Lake Erie at its front door, the City of Cleveland, Ohio, was still faced with the threat of a lack of water during the summer of 1947. Increased population and industrial activity brought about a greater demand for water. The daily consumption of water reached 331,000,000 gal. per day during the peak summer days. Since the maximum pump capacity was only 315,000,000 gal. per day, the excess demand could fortunately be supplied by the use of water stored in city reservoirs. Besides the possible curtailment of home construction and the inconvenience caused by the reduced water pressure, there is also necessity of maintaining adequate water pressure for fire fighting in the entire metropolitan area.

For these reasons the City of Cleveland is taking immediate steps to provide an additional supply of water. The first portion of this program is the Nottingham water project to be located in the eastern part of the Cleveland. When complete, this plant will provide an additional 100,000,000 gal. of water daily, thereby bringing the total capacity of the city supply to 415,000,000 gal. per day. The Nottingham project consists of a submerged intake crib, a 5 mile intake, a screen well, a filtration and pumping plant, and a filtered water reservoir.

Intake Crib and Intake

The intake crib and intake are under construction and should be complete before the end of 1949. Separate contracts were let for the marine and shore sections of the intake. The contract for the 3½ mile subaqueous section was awarded to Merritt-Chapman & Scott Co. for $4,261,842. This section will consist of reinforced concrete pipe having an inside diameter of 10 feet. The pipe will be manufactured in a temporary plant of the Lock Joint Pipe Co. to be located on city property at the shore end of the intake. The pipe will be manufactured in an upright position using collapsible steel forms and will be steam cured. Each section of the pipe will be 24 feet long and will weigh approximately 50 tons. In fact, the elbow section which is a part of the submerged intake will weigh approximately 150 tons. This unit will require special handling both in construction and placing. The 50-ton lengths of pipe will be loaded onto a scow, floated into position, and then lowered into an open-cut which has been excavated in the lake bottom.

These pipes will have slip joints with steel joint rings and rubber gaskets. They are to be held together by two 2-in. x 3 ft. - 2½ in. bolts with an ultimate strength of 115,000 P.S.I. at each joint. These bolts are to be supported by exterior brackets which will be welded to the reinforcing steel and cast into the pipe at the time of manufacture. Tightening of the bolts will be done by two divers, one working on

Construction View of 10 Ft. Intake Tunnel

1½ miles of tunnel on shore end of intake will connect with 3½ mile section of 10 ft .concrete pipe. Each length 24 ft. weighing 50 tons.

Construction View of 25 Mg. Filtered Water Reservoir to Cost $1,331,000

each side of the pipe. The open cut will be back filled so that there is at least four feet of cover over the intake line. The intake crib itself is of the submerged type with a clearance of 40 feet. The Kalill Company will construct the 1½ mile tunnel shore section of the intake. The tunnel section will also have an inside diameter of 10 feet and will be lined with reinforced concrete. This tunnel will terminate at the screen well. The contract price for this section is $1,844,739.

The screen well was constructed by the WPA in 1941. It is a reinforced concrete structure 88 feet deep with an inside diameter of 93 feet. This structure will house the raw water screen and pumps.

New Filtration Plant and 25 Mg. Reservoir

A reinforced concrete filtered water reservoir is now under construction at the Nottingham site. This covered reservoir will be 535 feet by 315 feet by 26 feet deep and will have a capacity of 25 million gallons at a contract price of $1,331,000.

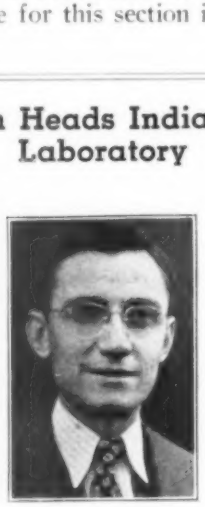
The Nottingham project will be completed by the construction of a pumping and filtration plant estimated to cost $11,250,000. This plant is in the design stage at present but is scheduled for completion before the end of 1949. Ultimately this plant may be enlarged to supply 150,000,000 gal. of water per day.

Revenue Bond Financing

A $27,000,000 revenue bond issue has been authorized by the Cleveland City Council for the financing of this project. $8,000,000 in bonds were issued in 1947, $12,000,000 more are contemplated in 1948. The money so raised will be used for the construction of the intake filtration and pumping plant, as well as construction of new feeder mains and storage reservoirs.

The Department of Public Utilities, through its Division of Water and Heat, is responsible for water works construction in Cleveland. Emil J. Crown is Director of Public Utilities and George W. Hamlin is the Commissioner of Water and Heat. The screen well was designed under the supervision of A. G. Levy, Engineer of Construction Surveys. Thomas A. Burke is the Mayor of Cleveland. The Nottingham intake and filtration plant were designed by Havens and Emerson, Cleveland, Consulting Engineers.

Kin Heads Indiana Laboratory



Stephen R. Kin, until recently in charge of the industrial waste program of the Bureau of Environmental Sanitation, of the Indiana State Board of Health under B. A. Poole, has been transferred to the division of laboratories of the Department and now heads the Laboratory of water and sewage analysis.

Mr. Kin has been with the Indiana Dept. of Health for more than two years having joined the staff at the end of the war during which he was engineer in charge of water and sewage at Camp Butner, N.C. Prior to his work at Camp Butner, Mr. Kin was a member of the laboratory staff of the Buffalo (N.Y.) Sewer Authority, where he was co-author of a number of papers on sewage chlorination. Mr. Kin has also authored a paper on activated sludge density currents, published in this magazine.

E. W. Bennison Receives Professional Degree

E. W. Bennison, Office Engineer of Edward E. Johnson, Inc., was awarded an advanced professional degree by the University of Nebraska.

The award was made for a thesis on the development of ground water.

Mr. Bennison, who appeared on the program of the A.W.W.A. in Atlantic City in May, is the author of "Ground Water—Its Development, Uses, and Conservation". He has served as Office Engineer for Edward E. Johnson, Inc., a well drilling company, since 1939. Mr. Bennison is a graduate of the University of Nebraska in 1909 and first became active in the field of ground water in 1924. In 1936 until 1939 he was district manager of the Pomona Pump Co. in Chicago.

N. D. Kenney Joins Andrews Associates

Norman D. Kenney, formerly of Requardt & Associates, engineers of Baltimore, Md., has joined the staff of G. Douglas Andrews Associates, engineering consultants of 212 Washington Ave., Towson, Md.

Mr. Kenney is a member of the A.S.C.E., A.W.W.A., and A.P.W.A.

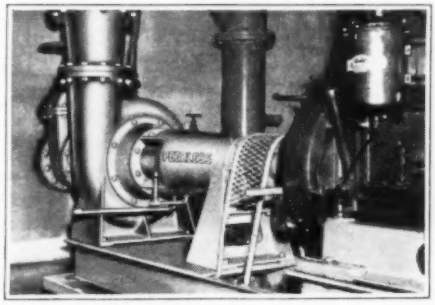
OXNARD, CALIF., UTILIZES SEWAGE TREATMENT BY-PRODUCTS

by
ORRIN L. ISHAM
Superintendent
WATER AND SEWAGE TREATMENT
OXNARD, CALIF.

OXNARD, California, is located near the Ventura Oil Fields, and extensive sources of natural gas in Southern California, but utilizes gas from sludge digestion to operate its sewage pumps. The sewage system at Oxnard was designed for a population load of 30,000. The system now serves approximately 24,000 persons, plus industries. In one of the industries a daily load of chopped bean pods and fruit is discharged into the sewer, adding an industrial load equivalent to a population of 10,000 persons. Thus the capacity of the sewage treatment works is being taxed at the present time. The average flow of the sewage treatment plant is 2.6 mgd. with a peak rate of 3.8 mgd. reached between 10 A.M. and 1 P.M.

The treatment plant consists of circular clarifiers and circular trickling filters with floating cover sludge digesters and sludge drying beds. All sewage reaching the plant has to be pumped and this 3000 gpm. pump is powered by a stationary gas engine operated on methane gas from the sludge digestion tank. The installation was set up by A. T. Mead, local representative of the Peerless Pump Division of Food Machinery Corp. A stock Enterprise gasoline engine was installed for which a special carburetor and manifold were provided for operation on sewage gas.

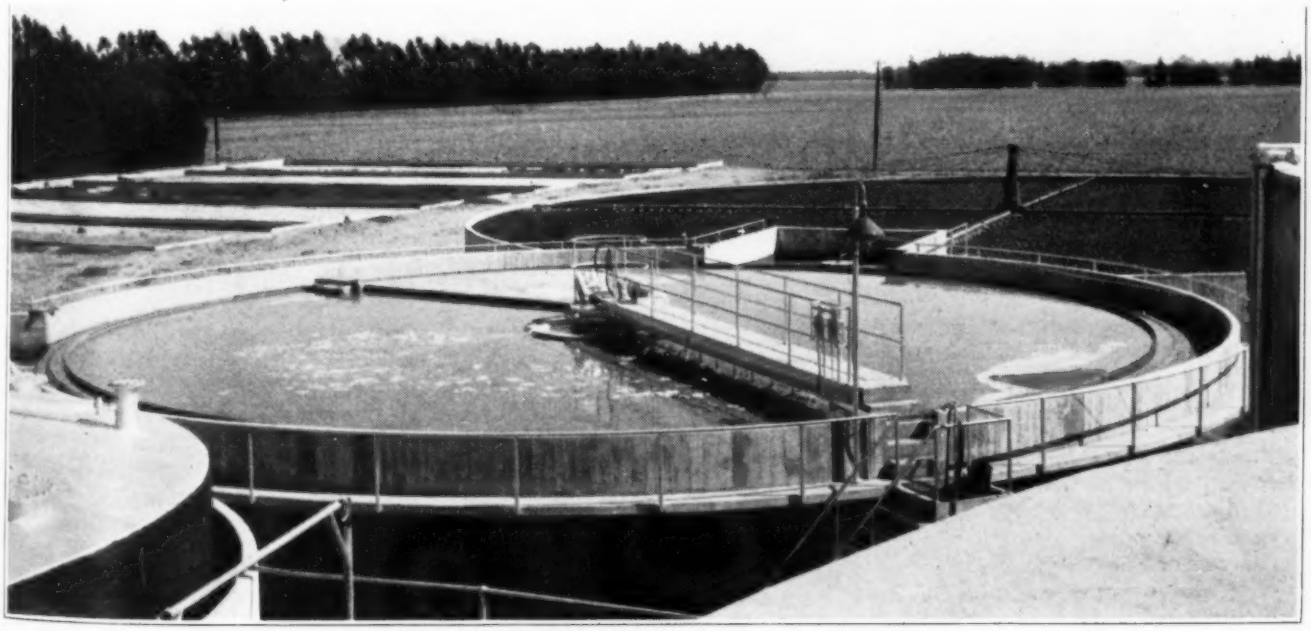
The Author



3000 gpm. Sewage Pump Powered by Engine Operating on Sewage Gas

The high sulphur content of the gas threatened a corrosion problem with the engine but this problem was solved by raising the temperature of the engine operation to 212 degrees at which temperature the corrosive action was eliminated. The higher operating temperature for the engine was accomplished by insulating the water inlet pipes. Hot water from the engine jacket was carried to the sludge digester to heat and maintain it at optimum temperature for production of gas.

The gas engine operates 24 hours a day continually except for shut downs once a month for oil changes. As the result of using this unit a savings of $100 a month on the fuel bill has been accomplished. Not only is the sewage sludge gas recovered and used, but the effluent from the trickling filter is used for irrigation purposes. Between the treatment plant and the ocean there lie 200 acres of rich lima bean land and the sewage plant effluent is used for irrigation of this area. Digested sludge is drawn to open sludge beds and is sold.



Oxnard, Calif., Sewage Treatment Plant.

Left, digestion tank with floating cover. Center, circular sedimentation tank. Right rear, rotary distributor on tricking filter. Left, rear, sludge drying beds. In distance, lima bean fields irrigated by plant effluent.

WHITE WATER TREATMENT AND RECOVERY*

II. Filtration and Filter Aids

By
WILLEM RUDOLFS and EARL J. AXE
Chief and Research Associate
RUTGERS UNIVERSITY, NEW BRUNSWICK, N. J.

FILTRATION, broadly speaking, is the separation of solids in suspension in liquids by straining through porous media. The character and size of the material to be removed and the degree of clarification desired usually determine the degree of openness of porosity of the filtering media.

In a survey it was learned that the volumes and the characteristics of paperboard waste vary widely. The concentration of finely divided material generally increases with the amount of recirculated water. This highly hydrated material averages 80 per cent organic matter and is particularly difficult to remove by ordinary settling or filtration.

Extraneous inert materials, particularly the diatomaceous siliceous earths, have been developed for use as filter aids in industrial filtrations. For experimental filtration of paperboard white water wastes, the grades of filter aids having higher ratios of larger particle sizes were selected to give maximum rates of flow. The figures in Table I show the approximate particle size distribution, apparent and cake densities, and porosity of the Celite filter aids used.

Several other filter aids—Dicalite "Speed Plus," comparable to "Hyflo Super-Cel," and Dicalite "4200," comparable to "545"—were also used for comparisons.

Filter Equipment and Technics

Vacuum filtrations were performed in glass laboratory equipment. Graduated cylinders served as receptacles for the filtrates, and a glass funnel with a sintered glass disc (0.0167 sq. ft.) provided a horizontal filter septum.

Pressure filtrations were performed in two types of filtering equipment: (1) A bomb type filter of 4-liter capacity in which a vertical cloth-covered filter leaf (.005 sq. ft.) suspended in the prefilt. Agitation of the prefilt was obtained by air. The filtration of slurries only was possible in this equipment. (2) A pressure filter

The Senior Author

in which the septum was a spirally wound wire candle (0.125 sq. ft.) enclosed in a glass cylinder of 3 inches inside diameter which permitted cake space of about one inch about the candle, allowing filtrations at pressures from 3 to 40 psi. The type of septum was not adaptable to filtrations without precoats.

Precoat Thickness Effect on Flow Rate

The thickness of precoat varies from 0.1 to 4.0 ounces per sq. ft. in industrial filtrations.

The resistance to the rate of flow offered by various thicknesses of several grades of filter aids was obtained with distilled water to determine the optimum precoat thickness and its effect on the rate of flow.

The rate of filtration of paperboard mill white water, without filter aids in suspension, is erratic because of the effect of the varying concentrations and character of the suspended material on the initial rate of flow, and the effect of the thickness of the precoat is generally obscured by these factors.

The average removal of volatile suspended material, generally exceeded 80 per cent when a precoat thickness of 1.0 ounce per sq. ft. or more was used.

Effects of Concentrations of Solids

To show the effects of dissimilar suspended solids normally found in wastes from different mills, filtrations were made to compare the relative volume-time relation when the suspended materials were in similar concentrations. Also to show the effects of dissimilar but of discrete solids, such as filter aids, filtrations were made with similar and varying concentrations of these solids, because they, too, affect differently the density and structure of the cake and impact.

The effects of increasing concentrations of solids of similar character on the volume-time relation for clarification by filtration of three wastes on the rates and yields are illustrated in Fig. 1. The effect of the concentrations of solids is similar for each waste, but the effect of similar concentrations in different wastes is dissimilar. Comparisons of the rates of flow and yields show that the volume-time relation of filtration is affected more by the varying character of the dissimilar solids than by the concentrations of solids normally found in the wastes.

The effects of increasing the concentration of solids in the wastes by the addition of rigid particles (filter aids) and thereby changing both the concentration of suspended solids and the ratio of deformable flocculent solids in this waste are shown in Fig. 2.

Comparison indicates significant differences in the nature of the volatile suspended materials which cannot be attributed to the concentrations of these materials or to the concentrations of the total suspended material.

The diminishing differences between the yields with increasing concentrations of filter aids, due to increasing thickness and resistance of the cake, make it impractical to increase the concentrations of filter aids

Table I

CHARACTERISTICS OF CELITE FILTER AIDS

	Particle Size Distribution Microns	Density Lb. per cu. ft. Apparent	Density Lb. per cu. ft. Cake	Porosity %
Hyflo Super-Cel	4-20	9.7	17-22	85
Celite 503	5-30	10.5	17-22	85
Celite 545	12-45	11.5	17-22	85

*Paper of the Journal Series, New Jersey Agricultural Experiment Station, Department of Sanitation, Rutgers University.

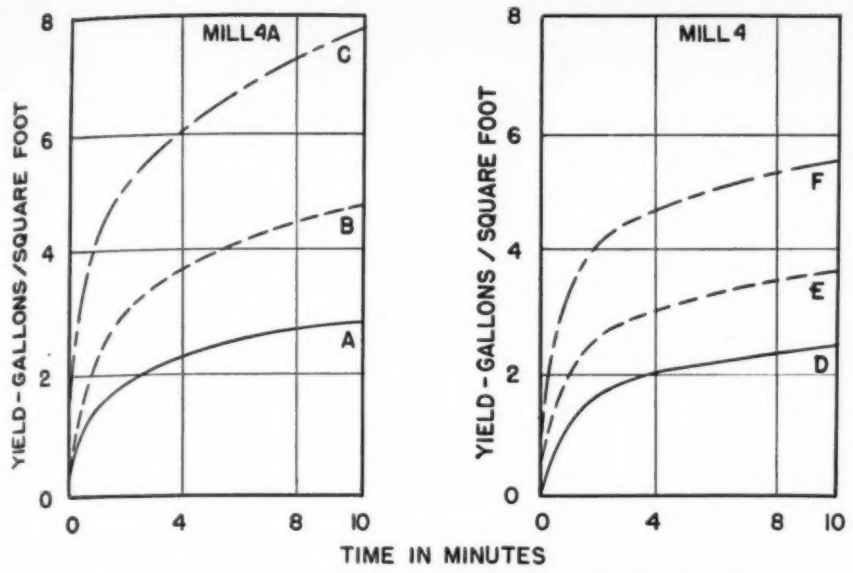


Fig. 1. Comparisons of Rates and Yields of Filtrations of Wastes with Similar and Dissimilar Solids Concentrations.

above the optimum quantity for a particular waste. The concentration and particularly the nature of the deformable suspended material determine the optimum concentration of filter aid for the optimum yield and, therefore, the filtration capacity required.

Effect of Character of Solids

Because the variations in the volume-time relations in the filtration of boardmill wastes cannot be satisfactorily explained by the concentrations of solids, a series of filtrations were made in which the solids present were altered in character by the addition of alum in both sub-floc and flocculating doses for comparison of the effect of increasing amounts of flocculent solids on the yields and rates of flow. The doses used were: 0.25 (sub-floc), 0.50, and 0.75 lb. per 1000 gal. The latter dose produced a clarifying floc. The same filter aid (Celite 503) in 0.1 per cent concentrations was added to both the untreated and the alum-treated portions of the wastes prior to filtration.

The yields and rates of typical filtrations of the wastes so treated and the comparisons are shown in Fig. 3. A comparison of the yields of the alum-treated portions with the untreated portion shows decreases in yield amounting to 40 to 60 per cent within the same filtration interval. The filtration cycles were shortened about 65 per cent.

Because there is no definite relation between either the filtering rates or the yields with the amounts of alum added, it appears that the effect of the alum is more closely related to the amount of hydrate precipitated than to the amount added. The alum used in the processing of paperboard in the mills would appear to be a factor to be taken into account in connection with the filtration of white waters.

Pressure Effects on Volume-Time Relation

In constant pressure filtrations the effect of pressure produces the velocity of flow of liquid through the filter media. The progressive reduction of void space produces a progressively increasing velocity of flow through the remaining void spaces, and the suspended material is deposited in the cake with increasing force and greater deformation, until complete cessation of flow results, although the pressure remains unchanged.

A series of filtrations were performed with the same wastes at constant pressures ranging from 3 to 14 psi., with and without suspensions of filter aids, for succeeding filtration cycles. The effect of pressure on the yields and rates of filtration varied with different samples. The trend of the effect of increasing pressure on the yield was, in general, a reduction in yield and rate, both with lower and higher concentration of suspended materials and may be advantageous to the yield with the lower concentration of solids until an optimum is obtained at between 10 and 14 psi.

Determination of the optimum ratio of filter aids to suspended materials appears to be imperative for constant pressure filtrations. With variable pressure filtrations the optimum pressure may be found for each ratio of filter aid to suspended materials. This ratio also varies with the concentrations of deformable solids. Generally, with ratios of 1.5 to 4:1, increasing pressures produce increasing yields until the adverse effect of cake thickness is felt in the yield, or available cake space is filled.

Studies on effect of increasing pressures on filter yields for filtrations, with and without precoats, indicate that the range of optimum pressures increases for similar or varying concentrations of suspended solids when filter aids in suspension are used in concentrations which upon deposition in the cake ameliorate the effect of increasing pressures on the deformable solids also deposited.

Comparison of Removals

The removal of suspended materials by filtration varied with the waste,

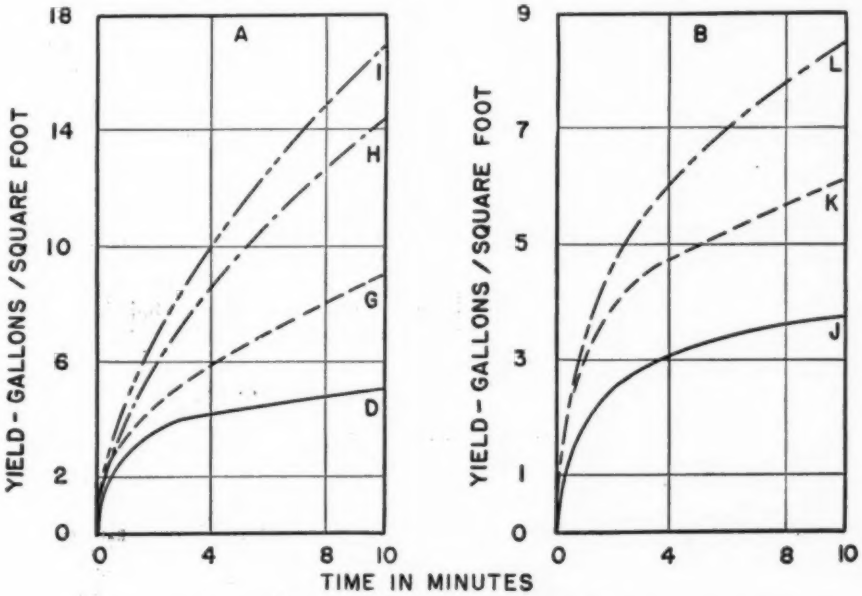


Fig. 2. Effect of Increasing the Rigid Solids Concentrations of the Filtration Rates and Yields.

generally with the amount of filter aid, and inversely with the rate of flow and the particle size of the filter aid.

The use of precoats produced greater initial clarification and reduced the amount of filter aid carried through the media at the onset of filtration. The average removal of suspended materials from paperboard white water by filtration with filter aids, in varying concentrations and grades by the various technics, is given in Table II.

The clarification of boardmill white water by filtration with filter aids effects a satisfactory degree of removal of suspended materials regardless of the variations in strength of waste or technique. Generally, constant pressure filtrations of white water resulted in short filtration cycles, which in practice increases the "out of service" time for cleaning of units and necessitates larger or more filter units for filtering a given volume of waste. Precoating in constant pressure filtrations increased the cycle somewhat but did not increase the yield, and required from 10 to 50 per cent additional filter aid material. In constant-flow filtrations in which the pressure was steadily increased to compensate for increasing cake resistance and then maintain a constant rate of discharge, the yields were higher and the cycle longer than for constant-pressure filtrations. Constant-flow filtrations with precoats resulted in higher rates and yields and longer filtration cycles with smaller quantities of filter aid in the prefilt, than were obtained with this technic without precoating.

For the consideration of the economic feasibility of increasing pressure filtrations of white water some assumptions must be made. Assume that a satisfactorily clarified filtrate is passed at an average rate of 3 gal. per sq. ft. per min. for a 35 min. period; then a 4-ounce precoat is used and a 0.1 per cent concentration of filter aid is in a 3 to 1 ratio to the suspended material in an average waste, and that by allowance for cake dumping by backwashing and for re-laying the succeeding precoat, a filtration cycle is completed in 41 minutes. At this rate 35 completed cycles are available

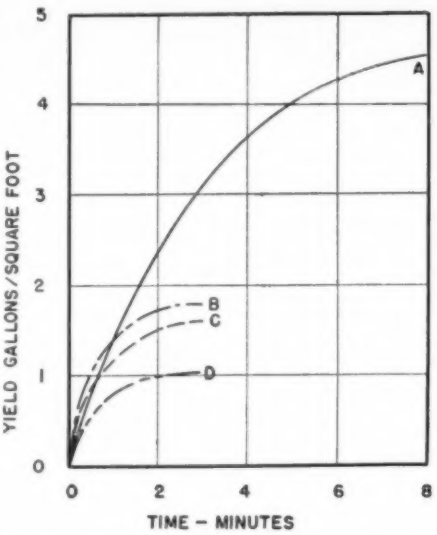


Fig. 3—Effect of Flocculant Alum on Filtration Rates and Yields.

(A = No Alum, B = 0.25 lb., C = 0.50 lb., D = 0.75 lb., per 1000 gal.)

each 24 hr. per mg. The area required to discharge 700 gal. per min. at a uniform rate of flow with a filter unit out of service 15 per cent of the time will be about 270 sq. ft. per min. per day. The required filter aid for precoating this area with 4 ounces per sq. ft. amounts to about 2400 lb. per mil. per gal. per day. The additional filter aid for the 0.10 per cent suspension requires 8,340 lb., or a total of about 10,750 lb. per mil. per gal. per day. If the suitable grade of filter aid is assumed to cost $65.00 per ton, the material cost approximates $350.00 per mil. gal. per day.

The acceptance of diatomaceous earths of filter aid grades by increasing numbers of paper producers for incorporation into quality products, in ratios of 5 to 15 per cent, to improve brightness, printing quality, and drying, suggests the possibility of incorporation of the cake containing the reclaimed fiber into the boardmill product. A survey disclosed that the average loss of fiber in paperboard mills amounted to about 1.5 tons per mil. gal. The recovery of this fiber and of the filter aid by their incorporation in the average daily production of 100 tons of board per mil. gal. produces a product containing about 5 per cent of the diatomaceous earth and is valued conservatively at $125.00 per ton. The 1.5 tons of recovered fiber and 5.25 tons of diatomaceous earth representing an outlay of about $400.00, now have increased in value about 100 per cent. This estimated return indicates the possible economic feasibility of filtration for the removal of suspended material in the mill effluent and the recovery of fiber and filter aid. Use of filter aid for clarification of effluents alone without reuse of cake appears to be too costly for the amount of work done and economically unsound if compared with results obtained by chemical treatment and settling or vacuum filtration.

Summary

Studies were made on the clarification of boardmill waste using various types of filter aids and three different methods of vacuum or pressure filtration. The removal of suspended material varied with the waste, generally with the amount of filter aid, and inversely with the rate of flow and the particle size of the filter aid. Removal of about 95 per cent suspended material was obtained by filtration with filter aids in suspension. The rates of flow depend primarily upon the resistance of the material deposited in the cake. The concentrations of filter aids required to maintain cake porosity depended upon the concentration, but particularly upon the nature of the solids in the wastes. Optimum pressures for maximum yields varied with the nature rather than with the concentration of solids in the wastes; consequently increasing concentrations of rigid solids (filter aids) allowed higher optimum pressures and increased rates of flow, with the limits of diminishing returns produced by resistance due to cake thickness. It appears that use of filter aids for clarification of boardmill is not commensurate with the cost, or in comparison with chemical treatment, but the possible economic feasibility of filtration for the removal of suspended solids from the mill effluent and recovery of fiber and filter aid by incorporation into the product is indicated.

Table II

AVERAGE FILTRATION YIELDS, RATES AND CLARIFICATION OF BOARDMILL WASTES BY FILTRATION AND FILTER AIDS

No. of Tests	Type of Filtration	Filtration Cycle min.	Filter Aids: Susp. %	Filter Aids: Ratio to Total Susp. Sol.	Filter Aids: Per 1,000 Gal., lb.	Yield gal./ sq. ft.	Rate gal./ sq. ft./ min.	Suspended Solids: Initial ppm.	Suspended Solids: Remaining ppm.	Suspended Solids: Rem. %
10	Constant Pressure Without Precoating	8.5	0.28	7.8:1	23.6	16.7	1.9	367	45	88
12	Constant Pressure, Precoat 4 ounce/sq. ft.	12.0	0.16	2.7:1	39.5	13	1.1	372	22	95
15	Increasing Pressure Without Precoat	18.5	0.19	3.8:1	15.8	27	1.45	499	26	93
15	Increasing Pressure, Precoat 4 ounce/sq. ft.	36.0	0.11	3.2:1	12.0	112	3.1	385	7	99

TRICKLING FILTERS FOR TREATING PULP AND PAPER MILL WASTES

Part I—Alkaline Wastes—(Concluded)

By HARRY W. GEHM
Technical Advisor
NATIONAL COUNCIL FOR STREAM IMPROVEMENT
OF THE PULP, PAPER AND PAPER BOARD INDUSTRIES, INC.
NEW YORK CITY

Because of the length of Part I, it was necessary to divide it between two issues. The first section appeared in the June issue; the second section appears herewith and contains the summary and references. Part II will follow in a later issue.—The Editors.

The Author

RAG MILL WASTE

EXPERIMENTS conducted at a mill pulping rags alone and producing water leaf paper from this pulp were described by Sheen [16]. A two stage filter employing two units, of one cubic yard volume, three feet in depth, was employed. The strength of the waste was varied purposely by including with the pulp wash water different quantities of boiler blow down liquor.

Throughout these tests the raw waste was adjusted with sulfuric acid to a pH of between seven and eight. The filters were seeded by operating them on polluted water until a satisfactory slime formed. Unfortunately temperature data were not collected. Throughout the test period the temperature was probably sufficiently constant so as to not affect results since tests were conducted over a short period of time and mill effluent temperatures are relatively constant over such a period.

A summary of the information obtained from the runs in which most satisfactory operation was obtained is shown in Table VII.

Filter efficiency reaches a maximum at a loading of about two pounds per cubic yard per day under which conditions overall reduction is approximately 60 per cent. That this reduction is effected irrespective of waste strength is probably due to the high recirculation ratios employed during all runs. An overall reduction of about 30 per cent in total solids accompanied B.O.D. reductions of 60 per cent.

Because of the limited time and number of the runs made and the variation in waste strength an evaluation of primary and secondary filter performance separately is difficult. However, on calculating overall B.O.D. reduction and loading of both filters a fairly good picture of the efficiencies was obtained. These are shown in Fig. 6 in which reduction is plotted against loading in terms of pounds per cubic yards per day. It is evident from examination of this curve that reductions increased with the loading until the loading reached two pounds. Reductions leveled off and appear to decrease at loading exceeding this value. Operating at peak efficiency a sixty-five per cent B.O.D. reduction is obtainable.

Trickling Filter Operating on Sulfite Waste at Appleton, Wisc.

MIXED PAPER WASTES

Southgate [11], [12] summarized trickling filter studies on various pulp and papermill wastes in England, where several small mills producing paper from mixtures of esparto straw, rag, and wood pulp have operated laboratory and pilot scale units. These installations are for the most part six or more feet in depth and are operated at relatively low loadings without recirculation. From most of the effluents treated the bulk of the alkaline pulping liquor was segregated, since it was found that the alkalinities present on their inclusion prevented development of a satisfactory flora. In all cases presettling and equalization in lagoons was practiced.

The most detailed information available is from laboratory and large scale two stage alternating filter operations conducted in recent years at one mill. The laboratory units were six feet in depth, nine inches in diameter and were filled with ¾ inch stone. After maturing on a diet of sanitary sewage alone, the waste admixed with various proportions of sewage and tap water was treated, the dosing order being reversed weekly. Table VIII below summarizes results obtained.

Despite the low loadings obtained, the company operating the mill believed the process had sufficient promise because of the degree of purification obtained and they proceeded with the installation of a pilot plant consisting of two filters 20 feet in diameter and 6 feet deep, containing two inch clinker media. Two runs of 66 and 108 days respectively were made. Before each, the filters were operated on sanitary sewage to insure a good slime growth on the stones. The maximum allowable proportion of spent pulping liquor was included in the waste fed to the filters (considerably higher loadings were employed than those tried in the laboratory) and no sewage or dilution water was added. Representative data obtained throughout these runs is presented in Table IX, together with computed loadings.

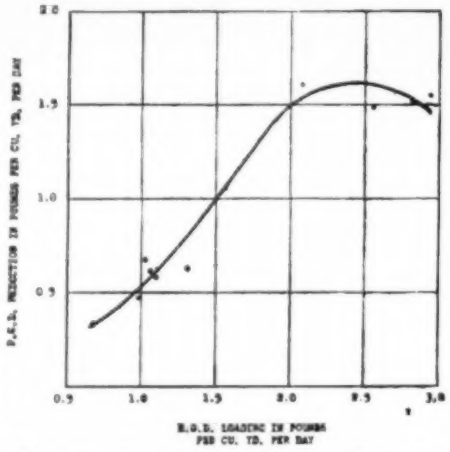


Fig. 6. Rag Mill Waste—Pounds B.O.D. Removed Plotted Against B.O.D. Loading

for by the lack of recirculation as it was quite evident from the work in this country that this is an important item if maximum loading and reductions are to be obtained with wastes of this strength. The rather erratic nature of some of the figures also indicate that possibly occasional slugs of highly alkaline waste reached the filters, causing a temporary diminution of their effectiveness. The most interesting period of test was the eighth where at a loading of 1.12 pounds per cu. yd. daily a reduction of 48.9 per cent in the B.O.D. was recorded for a feed of 900 ppm. In this case the first filter removed 28.9 per cent and the second an additional 20 per cent of the B.O.D. These degrees of efficiency are comparable with those obtained on the single unit strawboard filter operating with a minimum of recirculation.

It is unfortunate that no temperature data were included, since the lack of it prevents direct comparison with that obtained in this country on strawboard waste which these mixed wastes approximate in character and strength. It appears from inspection of the above data, however, that B.O.D. reductions were lower than those obtained by Bloodgood, et al, employing a single unit. This may be accounted

It may be safely concluded by comparing these studies with recent work in this country, that the latter have progressed further toward obtaining maximum efficiencies by virtue of modern innovations in the process, although the mixed waste may contain some substances more resistant to decomposition than the strawboard

Table VIII

LABORATORY FILTER DATA

Run in Days	Ratio Waste: Sewage: Water	Inf. B.O.D. ppm.	Eff. # 1 B.O.D. ppm.	Eff. # 2 B.O.D. ppm.	Percent Overall B.O.D. Reduction	Total Loading # Cu. Yd. Per Day Both Units
38	19:1:0	472	339	145	69	0.07
7	19:1:10	270	209	124	54	0.03
140	19:1:10	263	115	35	87	0.02
27	19:1:10	318	170	54	83	0.04

Table IX

DATA ON PILOT PLANT ON MIXED PAPER WASTE

Days of Test	Flow Gal. per Day per Cu. Yd.	Feed	B. O. D. Effluent 1st Filter	B. O. D. Effluent 2nd Filter	B. O. D. Percent Removal	Overall Loading # Cu. Yd. per Day
12	50	1410	1100	760	46.1	0.59
6	75	810	760	630	22.2	0.49
4	80	690	480	350	49.3	0.46
9	85	350	240	160	54.3	0.25
35	115	700	490	350	50.0	0.67
21	120	630	500	290	54.0	0.63
3	127	520	500	440	15.4	0.55
36	150	900	640	460	48.9	1.12
48	154	600	490	380	36.6	0.77

Table VII

TWO STAGE TRICKLING FILTER TREATMENT OF RAG PULP MILL WASTE

PRIMARY UNIT							SECONDARY UNIT						
Loading # Cu Yd per day	Recirc. Ratio	MGAD App.	B. O. D. Inf.	B. O. D. Eff.	% Rem.	# Rem. per Cu Yd	Loading # Cu Yd per day	Recirc. ratio	MGAD App.	B. O. D. Inf.	B. O. D. Eff.	% Rem.	# Rem. per Cu Yd
0.64	4.0	36	232	186	19.8	0.114	0.51	4.0	36	186	110	40.8	0.208
0.98	8.0	65	223	159	28.6	0.280	0.67	8.0	65	159	115	27.7	0.186
1.01	12.0	91	159	70	55.8	0.563	0.21	12.0	91	70	33	53.3	0.112
1.12	12.0	91	235	145	38.2	0.428	0.40	12.0	91	145	80	44.8	0.179
1.21	8.0	64	269	176	34.6	0.419	0.68	8.0	64	176	125	29.0	0.197
1.22	8.0	63	281	183	34.8	0.424	0.44	8.0	63	183	112	38.8	0.170
1.60	11.5	88	552	426	22.8	0.365	0.84	9.4	75	426	294	31.0	0.260
2.16	12.0	91	383	209	55.4	1.200	0.73	12.0	91	209	92	56.0	0.409
2.60	12.0	90	552	366	33.5	0.871	1.10	12.0	90	366	194	47.0	0.517
2.90	7.4	85	850	616	27.5	0.798	1.70	5.0	61	616	345	44.0	0.748

waste, particularly those derived from rag cooking.

In connection with a development project of the National Council for Stream Improvement at Kalamazoo, Mich., Morgan [13] made some exploratory experiments on the treatment of de-inking waste on a trickling filter. This work was not extended since a process of greater promise was finally selected for extensive development. Results of this research, however, are included here since they are believed to be indicative of what efficiencies can be obtained by this type of treatment.

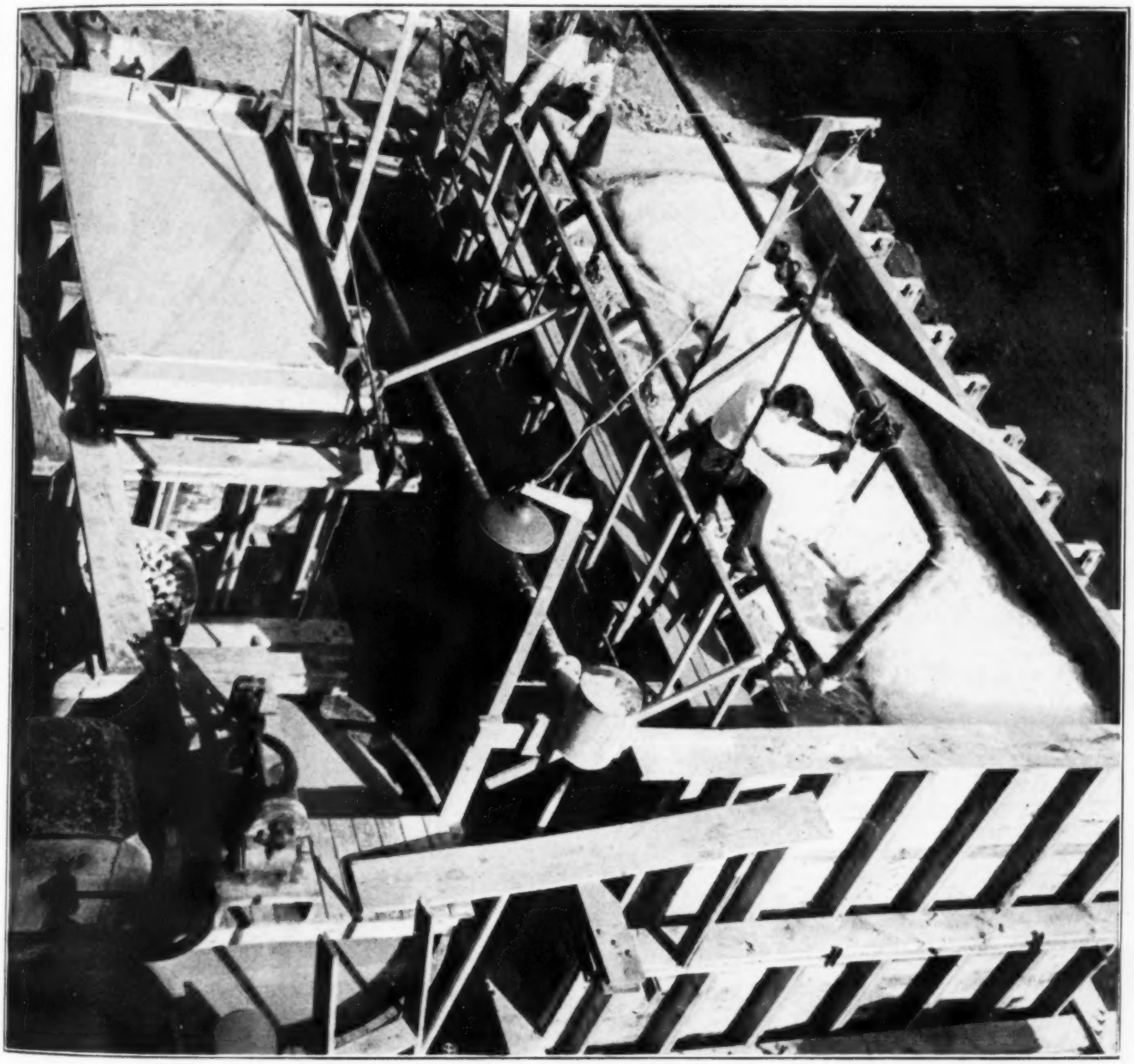
Table X shows a summary of the data obtained and the pertinent operating factors. It will be noted on examination of this table that despite optimum temperature conditions and nominal loadings, an average of but 30.7 per cent B.O.D. reduction was obtained. The addition of sodium nitrate to the filter influent failed to effect filter efficiency favorably. Recirculation was not practiced since it was felt that the initial B.O.D. was not sufficiently high to make this a particularly critical factor.

Table X
TRICKLING FILTER TREATMENT OF DE-INKING WASTE

Days of Test	B. O. D. (5 day) Filt. Inf.	Final Eff.	Per cent Red.	Loading # Cu. Yd. per Day
4	444	299	32.8	0.84
4	531	335	36.8	1.00
6	471	289	38.5	0.89
5	407	284	27.8	0.77
4	505	411	18.6	0.95
4	466	418	10.3	0.88
3	480	206	56.9	0.91
4	549	428	22.1	1.04
Average	482	334	30.7	0.91
	Sodium Nitrate Added			
5	375	282	24.8	0.70
5	422	321	23.9	0.79
5	364	239	34.4	0.68
8	402	336	16.4	0.74
1	370	300	17.8	0.70
Average	387	296	23.5	0.73

Temperature of Waste—Influent—31°C
Effluent—27°C
Recirculation—None
Application Rate—300,000 gal./acre/day

The reason for the low efficiencies obtained as compared to some other wastes is believed to be due to the relatively higher pH of this waste which generally exceeded 9.0 and the accompanying high alkalinities. This effect of high alkalinities was made very evident by some of the British research reported by Southgate [12].



Treatment of De-inking Waste by Aeration Process

Summary and Conclusions

The extensive experimental work brought together in the body of this paper indicate that the wastes produced by the alkaline pulp and paper making processes can be oxidized by the trickling filter. With the exception of kraft and de-inking mill waste the oxidation can be made to proceed to a high degree if sufficiently low loadings are applied or if two stages of filtration are employed, the first at high and the second at a low loading level. As far as operating procedure is concerned it appears that this must be adjusted to the particular waste handled if maximum efficiencies are to be obtained.

Attempts to step up efficiency to a point where filter installations could be reduced to practicable size by employing high degrees of recirculation and the addition of nitrogen salts did not yield promising results. In no instance were there the barest indication that efficiencies higher than those presently obtained for other wastes might be achieved. In fact in most instances the best results recorded indicated a lesser effectiveness of this device for these than for other wastes.

It seems apparent therefore, that, until some entirely novel means of stimulating filter activity is found, this form of treatment is not applicable to the bulk of the waste waters discharged by alkaline process pulp and paper mills with the possible exception of very small manufacturing units. This does not mean that in the future no use of trickling filters will be made by some units of the pulp and paper industry. They may be employed in some instances for handling certain portions of the waste or for effecting a polishing treatment following another process able to cope with the bulk of the waste more efficiently.

De-inking Waste Trickling Filter—Kalamazoo, Mich.

The developments of the controlled storage oxidation method for kraft wastes [14], an aeration process for de-inking waste [15] and high rate anaerobic digestion for strawboard waste [5] are examples of methods under development which are unquestionably more practical means of treating these wastes than the best trickling filter techniques in existence today, since this form of treatment would require expenditures for treatment works of the same order as the investment in the mill itself.

The actual magnitude of a filter installation is apparent when for example, the requirements of a one hundred ton strawboard mill is calculated from the existing development data. In order to obtain an effluent below 100 ppm. B.O.D. during the warmer months more than three acres of filter having a depth of six feet would be required to say nothing of accessory equipment which would have to include clarifiers, sludge disposal and a 15 mgd. pumping station to provide the required recirculation. In comparison the mill itself would be dwarfed by such a colossal appendage. This demonstrates clearly the necessity for finding improved methods of treatment for these waste waters through further research and development.

References

(1) Phelps, E. B., U.S.G.S., W.S. Paper 189 (1906)

(2) Royal Commission on Sewage Disposal, 9th Rept. (1915)

(3) Hommon, H. B., U.S.P.H.S. Bull. 97, (1918)

(4) National Council for Stream Improvement, Res. Rept. No. 7 (1947)

(5) National Council for Stream Improvement, Res. Rept. No. 15 (1947)

(6) Lea, W. L., Nichols, M. S., *Sew. Wks. Jour.* Vol. 8, No. 3 (1936)

(7) Bloodgood, D. and Erganian, G., *Sew. Wks. Jour.*, Vol. XIX, No. 6, (1947)

(8) Bloodgood, D. and Stahl, B. F., Proc. 4th Ind. Waste Conf., Purdue Univ., (1947)

(9) Davis, C. L., "Biological Treatment of Sulfate Mill Waste", Louisiana Cons. Rev. (1942)

(10) Davis, C. L., "Experiments and Studies of Int. Paper Co., Southern Kraft Div., On Its Waste Disposal Problem", Eng. Dept. Rpt. (1944)

(11) Southgate, B. A., *The Papermaker* and British Paper Trade Jour. 109, TS43 (1945)

(12) Southgate, B. A., *The Papermaker* and British Paper Trade Jour., 110, T.S.I., (1945)

(13) Morgan, P. F., Private Communication.

(14) National Council for Stream Improvement—Research Report No. 13 (1947)

(15) National Council for Stream Improvement—Research Report No. 5 (1946)

(16) Sheen, R. T., "White Water Treatment —An Industrial Waste Problem" *Paper Trade Journal*, Vol. 129, p. 9. (1948)

FIRST INTER-AMERICAN SANITARY ENGINEERING CONGRESS

The Inter-American Association of Sanitary Engineering (AIDIS) held its First Congress in Santiago, Chile, April 8-15.

Clarence I. Sterling, Jr., of the United States and Mr. Alberto Ortiz Irigoyen of Mexico were unanimously elected first President and Vice-President, respectively, of AIDIS. Mr. Sterling is Director of the Health and Sanitation Division of the Institute of Inter-American Affairs, and Mr. Ortiz Irigoyen, who also holds the position of President of the Association's Mexican Section, is the Chief, in Charge of Construction for Mexico's Secretaria de Recursos Hidraulicos. This agency is directly responsible for sanitary works planning and construction in that country. The Congress also elected Donald L. Snow, Sanitary Engineer with the U. S. Public Health Service assigned to the Pan American Sanitary Bureau's Lima, Peru, and Washington, D. C., offices, to serve as General Secretary of AIDIS.

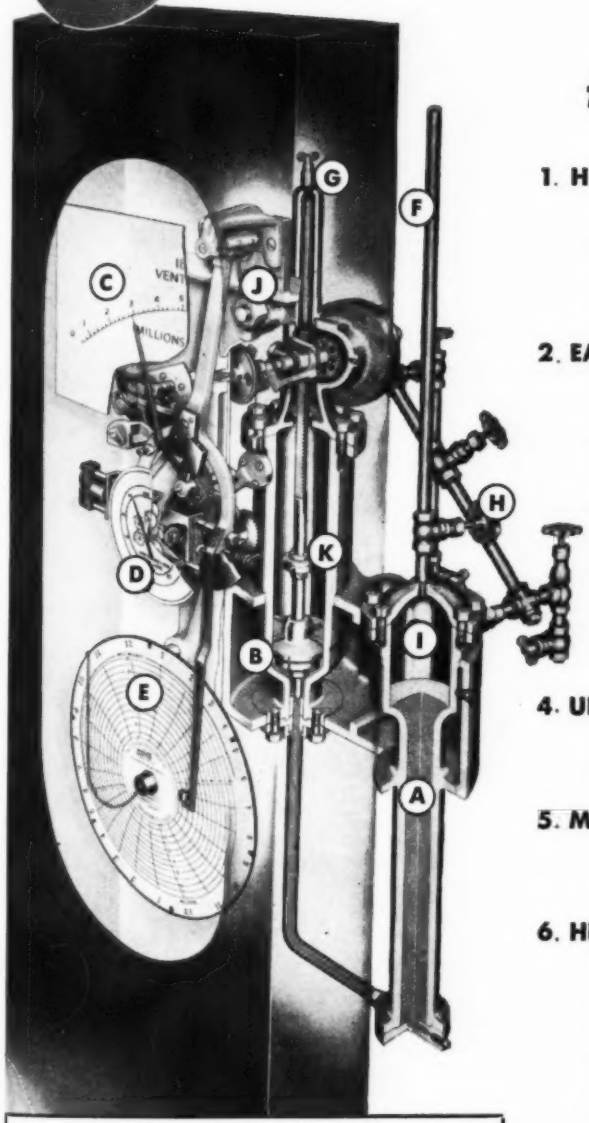
Mexico City has been selected as the site of the Second Inter-American Sanitary Engineering Congress scheduled for 1949.

By far the most successful of the three meetings which have been held, the Congress drew more than 250 members of AIDIS from 19 of the American Republics. Particularly large delegations attended from Argentina, Brazil, Peru, and Venezuela. The President of Chile, Mr. Gabriel Gonzalez Videla, officially opened the sessions. The Association now has over 1300 active members from the 21 Republics and national sections have been formed in the majority of the countries.

Papers on present and future programs of the national sanitary engineering departments in the various republics occupied the spotlight at the meetings as did a number of contributions on the development of water supplies.

8 GOOD REASONS!

Why Builders Type M Meter Instrument is THE BEST BUY for Water and Sewage Works



1. HEAVY-DUTY "POWER PLANT":
Large wells containing 35 lbs. of mercury (A) and a solid float of 10¼ sq. in. area having a vertical travel of 4½" (B) provide the reserve power necessary for years of super-sensitive, accurate, and trouble-free operation.

2. EASY-TO-READ DIALS:
Separate Indicator 10" long, uniformly-spaced, direct-reading graduations (C); direct-reading Totalizer: 6 dials, largest dial 3½" dia. with fast-moving hand for precision reading (D); uniformly-spaced, direct-reading Blueline Charts 12" nominal dia. for correct perspective and equal ease and accuracy of readings at low and high rates of flow (E).

3. BUILT-IN CALIBRATING DEVICE:
Accuracy of registration easily and quickly checked in the field by means of built-in water head test pipe (F).

4. UNAFFECTED BY TRAPPED AIR:
Trapped air has no effect on accuracy; air easily removed through a valve at the top of each well (G and H).

5. MEEHANITE IRON:
Mercury wells (I), main bracket on which mechanism and wells are mounted (J), and float (B) are high-tensile MEEHANITE iron.

6. HIGH ACCURACY — WIDE RANGE:
Registration with plus or minus 1% (response to differential induced by actual flow rate) over range of 100% to 6⅔% capacity for Model MDUA; within plus or minus ½% from 100% to 50% and within plus or minus 1% from 50% to 5% of capacity for Model MDUAX.

7. POSITIVE OVERLOAD CHECK:
Check valve (K) prevents loss of mercury even at extreme overload differentials.

8. LONG LIFE:
Type M Instruments installed over thirty-five years ago are still "going strong"!

For Bulletin D7-200, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 10 Codding Street, Providence 1, R. I.

BUILDERS PRODUCTS

VENTURI, PROPELOFLO AND ORIFICE METERS KENNISON NOZZLES • VENTURI FILTER CONTROLLERS AND GAUGES • CONVEYOFLO METERS • TYPE M AND FLO-WATCH INSTRUMENTS • WHEELER FILTER BOTTOMS • MASTER CONTROLLERS • FILTER OPERATING TABLES MANOMETERS • CHRONOFLO TELEMETERS

BUILDERS PROVIDENCE
Instruments

Pittsburgh Pipe Reconditioning . . .

Results of water main cleaning for the Department of Public Utilities, City of Cleveland, Ohio, show these remarkable production increases . . .

Length of Main	Size of Main	"C" Value Before Cleaning	"C" Value After Cleaning
25,000 ft.	16 in.	62	121
10,000 ft.	24 in.	81	122
35,000 ft.	30 in.	86	130

MAXIMUM LENGTH OF SINGLE RUN 28,000 FT. OF 30 IN. PIPE, PASSING THROUGH FIVE 24 IN. VALVES WITHOUT CUTTING PIPE.

They Said It Couldn't Be Done

WE DID IT!

And now . . . A complete survey of your water supply and disposal problems.

PITTSBURGH PIPE CLEANER CO.
133 DAHLEM ST. PITTSBURGH 6, PA.
PHILADELPHIA BALTIMORE WASHINGTON
NEW YORK BUFFALO CHICAGO
CINCINNATI ST. LOUIS DETROIT BOSTON

MEETINGS SCHEDULED

AUG. 11—SKOWHEGAN, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Water District, Winthrop, Me.

AUG. 23-25—CHATTANOOGA, TENN. (Hotel Patton)
Kentucky-Tennessee Section A.W.W.A.
and
Kentucky-Tennessee Industrial Wastes & Sewage Works Assn. Sec'y, R. P. Farrell, 420 6th Ave., N., Nashville, Tenn.

AUG. 23-25—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Association. Sec'y-Treas., I. M. Glace, 1001 Front St., Harrisburg, Pa.

AUG. 25-27—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Sewage & Industrial Wastes Association. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

SEPT. 1-2—WINNIPEG, CAN. (Royal Alexandria Hotel)
Minnesota Section, A.W.W.A. Sec'y, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

SEPT. Date not set—MINOT, NO. DAK.
North Dakota Water & Sewage Works Conference. (20th Annual Convention.) Sec'y-Treas., Jerome H. Svore, State Health Dept., Bismarck, N. Dak.

SEPT. 14-15—DES MOINES, IOWA (Hotel Kirkwood)
Iowa Sewage Works Association. Sec'y-Treas., Leo Holtkamp, P. O. Box 310, Webster City, Iowa.

SEPT. 14-17—NEW YORK, N. Y. (Hotel Pennsylvania)
New England Water Works Association. Sec'y, Joseph C. Knox, 609 Statler Bldg., Boston, Mass.

SEPT. 14-17—NEW YORK, N. Y. (Hotel Pennsylvania)
New York Section A.W.W.A. Sec'y, R. W. Blanchard, 50 West 50th St., New York, N. Y.

SEPT. 16-17—CHEYENNE, WYO. (Hotel Plains)
Rocky Mountain Section A.W.W.A. Sec'y, O. J. Ripple, 710 Colorado Bldg., Denver 2, Colo.

SEPT. 21-22—LAFAYETTE, IND. (Memorial Union Bldg. Purdue Univ.)
Fourth Industrial Waste Utilization Conference. Chairman, Prof. Don E. Bloodgood, School of C. E., Purdue Univ., Lafayette, Ind.

SEPT. 22-24—FLINT, MICH. (Hotel Durant)
Michigan Section A.W.W.A. Sec'y, Raymond J. Faust, State Dept. of Health, Lansing, Mich.

SEPT. 22-24—ATLANTA, GA. (Ga., Institute of Technology)
Georgia Water & Sewage Association and Georgia Water & Sewage Works School (17th Annual Meeting). Sec'y, Van P. Enloe, R. F. D. 7, Box 372, Atlanta, Ga.

SEPT. 29-30—CLARKSBURG, W.VA. (Stonewall Jackson Hotel)
West Virginia Section A.W.W.A. Sec'y, John B. Harrington, State Dept. of Health, Charleston, W. Va.

SEPT. 30-OCT. 2—CLARKSBURG, W.VA. (Stonewall Jackson Hotel)
West Virginia Sewage & Industrial Wastes Association. (Annual Meeting) Sec'y, R. G. McCall, Room 643, Capitol Bldg., Charleston, W. Va.

SEPT. 30-OCT. 1—SIOUX FALLS, SO. DAK. (Carpenter Hotel)
South Dakota Water & Sewage Works Conference. Sec'y, W. W. Towne, State Board of Health, Pierre, So. Dakota.

OCT. 5-6—FORT DODGE, IOWA (Hotel Wahkonsa)
Iowa Section A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

OCT. 7-8—MANSFIELD, OHIO (Mansfield-Leland Hotel)
Ohio Section A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 3, Ohio.

OCT. 10-13—GALVESTON, TEXAS (Buccaneer Hotel)
Southwest Section A.W.WA. Sec'y-Treas., L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

OCT. 13—FRYEBURG, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt., Water District, Winthrop, Me.

MEETINGS SCHEDULED

OCT. 13-15—ATLANTIC CITY, N.J. (Haddon Hall)
Pennsylvania Water Works Association (52nd Annual Meeting). Sec'y, E. R. Hannum, P. O. Box 315, Windber, Pa.

OCT. 13-15—BOSTON, MASS. (Statler Hotel)
American Society of Civil Engineers. (Fall Meeting.) Asst. Sec'y, Allen Wagner, 33 West 39th Street, New York 18, N. Y.

OCT. 13-15—MONTGOMERY, ALA. (Whitley Hotel)
Alabama-Mississippi Section, A.W.W.A. Sec'y, John L. Snow, First National Bank Bldg., Montgomery, Ala.

OCT. 15-17—PHOENIX, ARIZ. (Hotel Westward Ho)
Arizona Water & Sewage Works Association and **Arizona Section A.W.WA.**. Sec'y, Helen Rotthaus, Sanitary Engineering Div., State Capitol, Phoenix, Ariz.

OCT. 17-20—BOSTON, MASS. (Copley Plaza Hotel)
Public Works Congress. Executive Director, Donald F. Herrick, American Public Works Association, 1313 East 60th St., Chicago 37, Ill.

OCT. 18-21—DETROIT, MICH. (Hotel Statler)
Federation of Sewage Works Associations. Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.
Michigan Sewage Works Association. Sec'y-Treas., R. J. Smith, 545 Elizabeth St., E. Lansing, Mich.

OCT. 20-22—PHILADELPHIA, PA. (Penn Sheraton Hotel)
4-States Section A.W.W.A. Sec'y, W. A. Welch, 748 Public Ledger Bldg., Philadelphia 6, Pa.
(Joint Meeting)
Western Penna. Section A.W.W.A. Sec'y, L. S. Morgan, State Department of Health, Greensburg, Pa.

OCT. 24-26—JEFFERSON CITY, MO. (Hotel Governor)
Missouri Section A.W.W.A. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

OCT. 25-26—RICHMOND, VA. (Hotel John Marshall)
Virginia Section A.W.W.A. Sec'y, W. H. Shewbridge, 708 State Office Bldg., Richmond 19, Va.

OCT. 26-27—SPRINGFIELD, ILL. (Leland Hotel)
Illinois Water Works Operators' Association. Sec'y, C. E. Corrington, Clinton, Ill.

Oct. 27-29—RIVERSIDE, CALIF. (Mission Inn)
California Section A.W.W.A. Sec'y, H. C. Medbery, Water Department, 425 Mason St., San Francisco, Calif.

OCT. 28-29—LA CROSSE, WIS. (Hotel Stoddard)
Wisconsin Section, A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison, Wis.

NOV. 4-6—ATLANTIC CITY, N.J. (Madison Hotel)
New Jersey Section, A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N. J.

NOV. 8-10—ASHEVILLE, N.C. (Hotel George Vanderbilt)
North Carolina Section A.W.W.A. Sec'y, G. S. Moore, Supt. Water & Light, Albemarle, N. C.
and
North Carolina Sewage Works Association. Sec'y-Treas., G. S. Moore, P. O. Box 125, Albemarle, N. C.

NOV. 8-12—BOSTON, MASS. (Sessions-Mechanic Bldg.)
American Public Health Association. Sec'y, Dr. Reginald M. Atwater, 1790 Broadway, New York 9, N. Y.

NOV. 18-20—PANAMA CITY, FLA. (Hotel Dixie Sherman)
Florida Section A.W.W.A. Sec'y, S. K. Keller, Box 151, Clearwater, Fla.

DEC. 8—WATERVILLE, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt., Water District, Winthrop, Me.

In the Field of Irrigation

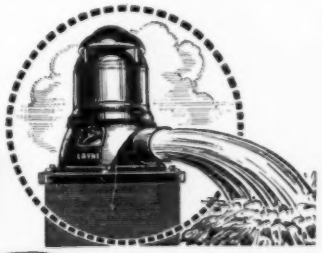
It is in the field of Irrigation that Layne Well Water Systems and Layne Vertical Turbine Pumps are most appreciated for their outstanding superiority of design, construction and quality. Of all places, the Irrigation field must have the utmost in dependability for long periods of continuous pumping. It is in this field that Layne water producing equipment is easily a 10 to 1 favorite in every case where ground water is used. Such leadership is highly complimentary to excellence of performance.

Basically, Layne Well Water Systems are extremely practical in design, and this design is noted for high efficiency. And supporting practical design and high efficiency, there is that well known Layne quality that assures longer life and practically no upkeep expense.

Layne Well Water Systems are designed for use in all situations where huge quantities of water must be produced at the lowest possible cost; packing houses, municipalities, factories, chemical processing plants, milk plants, petroleum refineries, railroads, etc.

For further interesting facts, literature, bulletins, etc., address

LAYNE & BOWLER, INC.
General Offices
MEMPHIS 8, TENNESSEE

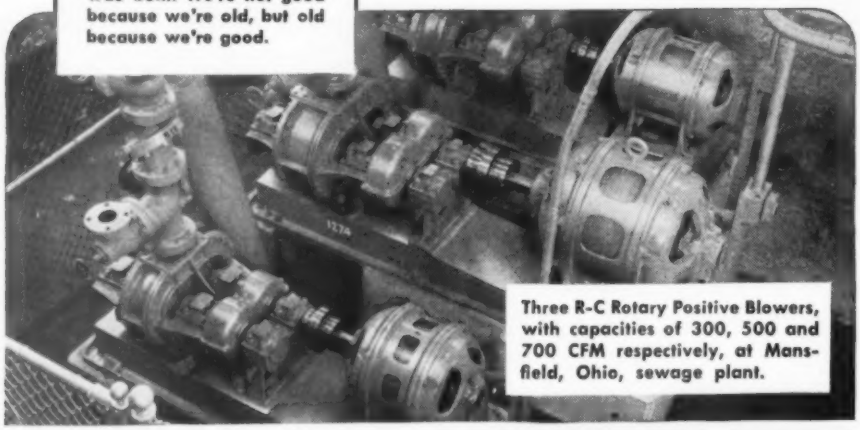


LAYNE
WELL WATER Systems

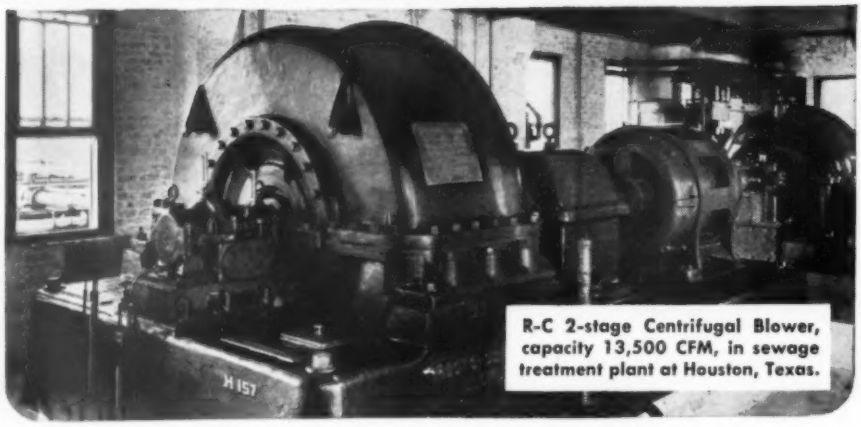
AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Washington ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minnesota, Minneapolis, Minnesota ★ International Water Supply Ltd., London, Ontario, Canada ★ Layne-Hispano Americana, S. A., Mexico, D. F.

Oil was first produced by drilling in 1859, five years after the first Roots Blower was built. We're not good because we're old, but old because we're good.

NO "HEDGING" ON BLOWER QUESTIONS FROM *R-C dual-ability*



Three R-C Rotary Positive Blowers, with capacities of 300, 500 and 700 CFM respectively, at Mansfield, Ohio, sewage plant.



R-C 2-stage Centrifugal Blower, capacity 13,500 CFM, in sewage treatment plant at Houston, Texas.

When you ask Roots-Connersville engineers about blowers or gas pumps for sewage plant or waterworks applications, you'll get unbiased answers, without "hedging" between Centrifugal or Rotary Positive equipment.

That's because of our *dual-ability* to design and build both types. We recommend whichever is best suited to the specific application. We are the only blower builders offering you this important *dual choice* . . . an advantage which usually saves time, money and trouble.

Our long experience in supplying sewage plant and waterworks equipment, including meters and vacuum pumps as well as blowers and gas pumps, results in reliable and economical performance of R-C units.

For straight answers that mean long-time satisfaction, consult R-C *dual-ability*.

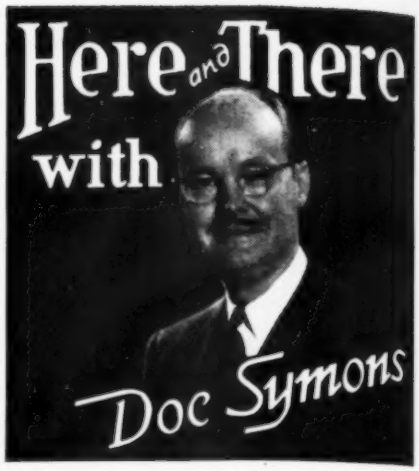
ROOTS-CONNERSVILLE BLOWER CORPORATION
807 Mount Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE ROTARY CENTRIFUGAL — BLOWER BUILDERS R-C SINCE 1854

BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

ONE OF THE DRESSER INDUSTRIES

Here and There with Doc Symons



H.T.M.A.—But not for long.—You will remember, (I hope) that in my May column I said that in June I would take a vacation and the July column would be prepared by members of the Ancient and Honorable Order of Sewer Rats of Ontario—and their wives.—Well, I haven't had the vacation but Bert Berry's Ontario gang took me up—so, with your permission, I'll delay the completion of the story of the Atlantic City A.W.W.A. Convention until the August column.—Without further ado, then, here's the column prepared by my Canadian friends of the A.H.O.S.R.O.

* * *

Here's That Man Again

Hello To My Admirers—
Especially to YOU,
I wish I could remember
If your eyes are brown or blue.

Your hair is blonde and gorgeous
Or is it dark?—or red?
I wish I'd made a memo
Of the things you wore and said.

You're tall—or are you shortish
You're slender—no, you're fat.
Say Darling, which convention
Did I chance to meet you at?

* * *

"Oh, wad some power
The giftie gie us
To see oursels'
As ithers see us."

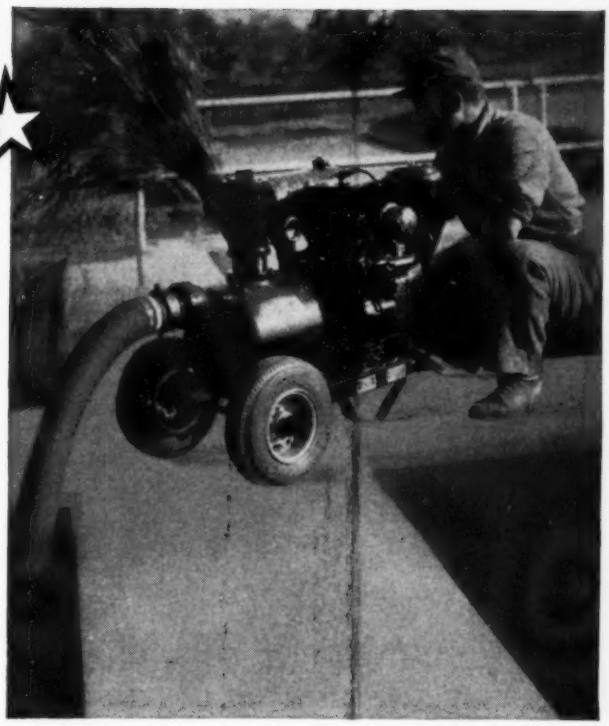
* * *

How are we doing, Doc?

* * *

Just like Doc, we're modest too and don't like to talk about ourselves, but we cannot overlook this opportunity (we'll probably not have another) to let our friends across the border know that the A.H.O.S.R.O. is an organization with the highest ideal—to so work and strive that all people may eat, sleep, ablute and live freer by reason of their works of art. It was conceived in the bowels of the "Home Sewer" at the Experimental Station of The Ontario Department of Health some twenty-five years ago. The

CARTER SELF-PRIMING CENTRIFUGAL PUMPS



Featuring a new and more efficient priming principle, CARTER pumps have again taken the lead in giving more service per dollar than any other competitive model.

It's experience that makes this difference—and it's experience coupled with dependability and engineering skill in developing the best possible product that you, the prospective buyer, must consider in choosing the pump to do your job.

Next time select the pump which for fifty-one years has maintained its leadership in the contracting field.—Next time say CARTER, the "Humdinger" pump.

● *Write for Bulletin 4503.*

★ *OTHER EQUIPMENT* •
MIXING • FLOCCULATION • DIGESTERS •
ALTERNATING SIPHONS • CLARIFIERS •
ROTARY DISTRIBUTORS • SLUDGE PUMPS •
SELF-PRIMING CENTRIFUGAL PUMPS •
DIAPHRAGM PUMPS • PNEUMATIC EJECTORS

RALPH B. CARTER COMPANY
HACKENSACK, NEW JERSEY

INFILCO

Water Conditioning and Sewage Treatment EQUIPMENT

ACCELATOR*
SOFTENING and CLARIFICATION } ACCELERATED!

Cleaner effluent, longer filter runs, more complete chemical utilization.

WRITE FOR BULLETIN 1824
*Trade-Mark Reg. U. S. Pat. Off.

RESEARCH FIRST for Over FIFTY YEARS ENGINEERING

Write or Call Nearest Field Engineer or Chicago Headquarters

Atlanta, Baton Rouge, Boston, Cleveland, Denver, Detroit, El Paso, Houston, Indianapolis, Los Angeles, Minneapolis, New York City, Omaha, Orlando, Fla., Pittsburgh, Philadelphia, St. Louis, San Diego, San Francisco, Seattle, Tulsa

INFILCO INC. • 325 WEST 25TH PLACE • CHICAGO 16, ILLINOIS

5 GOOD REASONS
for buying Blaw-Knox Grating
. . . COUNT 'EM!

1. STRONG electroforged construction for easy erection.
2. MAXIMUM OPEN AREA for light and air.
3. EASY TO MAINTAIN . . . paint reaches entire surface.
4. SELF-CLEANING, no sharp corners to clog.
5. SAFE footing at all times with twisted cross bar.

BLAW-KNOX DIVISION
of BLAW-KNOX CO.
2051 Farmers Bank Bldg.
Pittsburgh 22, Pa.

BLAW-KNOX ELECTROFORGED STEEL GRATING

membership, of necessity, is carefully selected for only those who are constitutionally strong can pass the trying ordeals necessary to qualify.

Crest of the A.H.O.S.R.O.

Over the years, we have had the honor of placing the brand of the order on a few of our American friends. Among those currently prominent in water and sewage works fields, are Linn Enslow, Abel Wolman, and Jerry McCarthy.

* * *

During these trying times of soaring food prices, any information which will help the struggling housewife to live within her budget would be welcome. We think that Doc should print in his column his recipe for "dry" tea. How many conventions do you get on one tea-bag, Doc?

* * *

Many of you must have heard that story of Doc's about the peanut. Take a tip from us, Doc, if you ever tell that one at a Federation meeting, be sure you masticate well, or some wide-awake sewage plant operator will call your bluff.

* * *

Things we would like to know:—

If Harry Jordan still requires all that "Java" in the morning to quench his thirst and why?

If Jerry (Monsanto) McCarthy remembers the night he gave the rebel yell and what prompted him to so express himself?

Why Earl Devendorf ran for a taxi when he left Hogate's in Washington recently?

Doc Symons' recipe for removing lipstick from shirts and collars.

Junior wants to know why "Sig" Sigworth doesn't give "daddy" some "bubble" gum to take home with him from the convention.

If "Bert" (A.E.) Berry and "Cap" (A.V.) Delaporte still go out for midnight milk shake cocktails when they go to Detroit?

When is Virginia (Doc's girl) coming up to see us?

* * *

Doc's reference in his May Column to the excellent dancing teachers among the wives of Bert (A.E.) Berry's, Ontario Department of Health staff has caused some remorse on the part of one of that fair group. She offers this, Doc—just for you.

H. T. M. A.

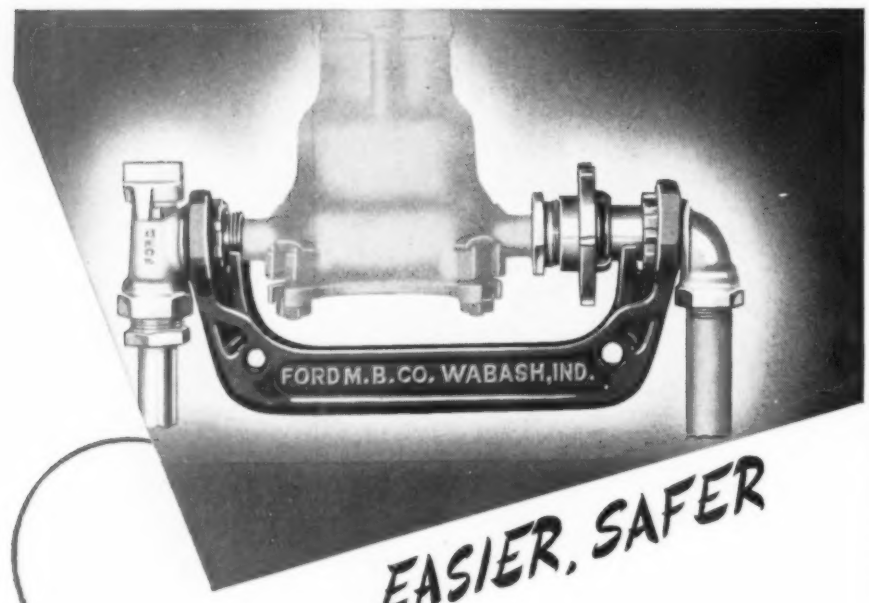
Now, How To Make Amend?
My heart is sore, distraught
To think you'd miss the trend
Of my most secret thought.
You. whom I so admire—
Why did you hesitate
When my supreme desire
Was just to demonstrate
The pleasure of a dance
In your embracing arms
And so I missed the chance
To estimate your charms.

* * *

Speaking of Public Relations, our hats are off to John (Michigan State) Hepler for his courtesy in granting interviews to local papers and even posing to have his photograph taken.

* * *

A salute to Paul Weir of Atlanta, Ga., from his Canadian Friends, on his election to the Presidency of the Fuller Award Society. His selection at the breakfast meeting at Atlantic City started the Society off on a bright year with hopes high for a solution of some of the knotty problems confronting this group. In fact, the South is doing pretty well for itself, and for the A.W.W.A.—A Vice-President for Dr. A. P. Black, and the head of the Fuller Award Society for



EASIER, SAFER

METER INSTALLATIONS WITH

FORD YOKES

Rigid, constant spacing of the Ford Yoke makes meter setting and changing surprisingly easy. Inlet and outlet pipes are permanently connected and aligned even when meter has been removed. No dangerous yanking or twisting of pipes is ever necessary. The simple expansion connection needs no wrenches yet makes a tight, trouble-free meter installation. When meter is removed, the expansion fitting stays with it, making water stealing quite impractical.

Ford Yokes are made in three types, Riser Yokes, Angle Yokes and Straight Line Yokes. All are equipped with proper fittings and gaskets. In ordinary usage, they last a lifetime.

Send for Complete Ford Catalog

FOR BETTER WATER SERVICES

FORD

THE FORD METER BOX COMPANY, INC.
Wabash, Indiana

LUMETRON

Photoelectric Colorimeter Model 450 for Nessler Tubes

A new photoelectric instrument of high accuracy for the measurement of color and turbidity, as well as for all analytical colorimetric tests in the examination of water and sewage.

- Turbidity tests in terms of APHA (ppm) scale.
- Color tests in terms of APHA (mg Pt) scale.
- Suited for determination of ammonia nitrogen, nitrate, nitrite, and for all other colorimetric tests according to APHA "Standard Methods."
- Operates with all "low form" Nessler tubes 32 mm O.D., 200 mm high. Requires no matched sets of tubes.

LUMETRON Mod. 450 eliminates the uncertainties of visual matching methods. It requires no permanent color standards and furnishes reproducible results independent of individual judgment and of light conditions.

Write for literature to

PHOTOVOLT CORP.
95 Madison Ave. New York 16, N. Y.

Write also for literature on

PHOTOVOLT Line-Operated pH METER

THERE IS NO EXCUSE FOR

Sewer HALITOSIS

Stop Odor Complaints
Prevent H_2S Corrosion
Cut Maintenance Costs
Control Sewer Insects
Reduce E. Coli Counts

and receive a Non-Septic Sewage, easy to handle, at your plant

all with
UP-SEWER Cloroben TREATMENT

THE CLOROBEN CORPORATION
15 EXCHANGE PLACE JERSEY CITY 2, N. J.

The Pioneers of Up-Sewer Treatment

THE PIPE VISE that's your *On-the-Job* WORKBENCH

RIDGID big-tray Tristand is a cinch to carry and set up anywhere needed

● Much more than just a vise, the popular RIDGID Tristand is really a portable workbench. Hinged legs fold in and chain for carrying; easily set up, tip proof. Roomy stand for dope pot, oil can; special slotted rim for hanging tools; pipe rest and 3 benders that won't dent pipe. Vise has tool-steel LonGrip jaws that provide firm hold, won't mar polished pipe. Chain vise, 4" capacity; yoke vise, 2½." It's a great work-saver en route . . . and on the job. Order from your Supply House.

Tristand Vise—ready to load on your truck.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

Paul. (And don't forget, kids, L.H.E. is from the state of Virginia, suh!)

* * *

The genius of "Bill" Orchard in producing a fine evening of entertainment has not been dimmed over the years. Once again at Atlantic City he proved he can pick the talent and entertainment to suit the occasion. Some of these times we are going to issue a "mandamus" to you "Bill" to see what you can do with the wealth of amateur talent that has been demonstrated in the "Club Room" at Canadian Section meetings. To ensure there will be no escape we shall have the order served personally through Jim Kinney.

* * *

Now that Atlantic City is history, what about the Federation meeting in Detroit? What has Pete Wisely and the local committee in store for us? —A wonderful gathering, and a great success, no doubt.

* * *

This is the vacation season and we cannot refrain from writing a few words to extoll the many tourist attractions of this fair Province of ours. Stretching half way across the continent, as it does, and with an area of more than 412,000 square miles, the Province of Ontario offers a diversity of year-round activities which have won for it the title—"Canada's Vacation Province". Within its boundaries are to be found so many features of entertainment, sport and pure relaxation that it is difficult to enumerate them without the details being lost in the tremendous over-all picture. So, come up and see us some time. We're sure you will find the trip worth while.

* * *

Memo to the Pee Bees—Rumor, from an unreliable source, has it that Ross L. (Peterborough, Can.) Dobbin, after a recent success in the publishing field, is now proposing to "redouble" our friend Marsden C. Smith, and make a bid with his own version of "How I Play At Bridge". Ross likes "conventions" because they enable him to play his favorite game better. He thinks that with his unexcelled finesse, he can make this contract easily.

* * *

Greetings to Mary Elva and our congratulations to Linn Enslow on his recent elevation to the presidency of the A.W.W.A. Linn is the second member of our order who has been so highly honored—the first being Abel Wolman. Nice going, Linn. We're proud of you!

* * *

Not only is Ontario a tourist's paradise, but we also make some swell cheese up here. Ask Jerry (Buffalo W.W.) Kreinheder how he liked that supply of "Black Diamond" he took home from the Canadian Section, A.W.W.A. meeting and Dick (Gen. Chem.) Ockerhausen might put in a plug or two for the Oka and limburger brands. Is it true, Doc, that when the airport officials at Buffalo learned the cargo Dick was bringing aboard, they cancelled all flights?

* * *

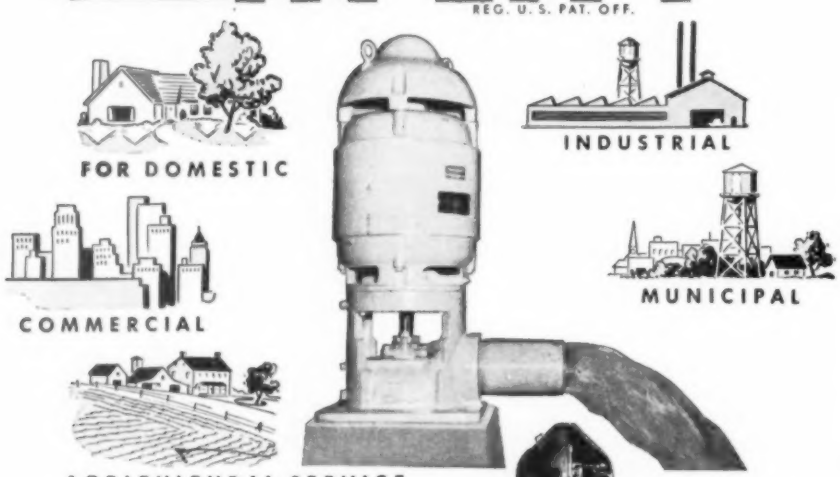
Well, Doc, you called our bluff.
Pied Piper and his men
Have writ this awful stuff.
Their wives helped now and then.

We've scraped the sewers clean.
Here are the choicest bits
To print where they'll be seen
We hope we've made some hits.

But we fear for your Relations
As the storm of protest swells
For despite great expectations
This month, your column smells.

We love you, Doc, and so
We've tried so hard to please,
Just this before we go—
Thanks for the memories.

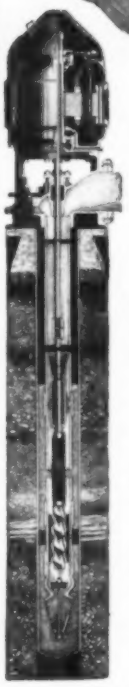
PEERLESS HI-LIFT
REG. U. S. PAT. OFF.



The low cost pump for developing a maximum water supply from small diameter wells

Here is one of the most simple and most positive of all deep well water pumping systems. The HiLlift pump has almost universal application because it's easy to understand, install and operate. In the Hi-Lift, Peerless utilizes an ingenious pumping element to literally squeeze water upward. Its pumping element consists simply of a hard chrome helically contoured rotor revolving in a similarly contoured rubber stator. That's all there is to this positive Peerless method of water lifting. It's the most forward step in pumping developed in the last 10 years, proved by thousands of successful installations in all kinds of service.

Peerless Bulletin B-142 fully describes and illustrates the many advantages of the Hi-Lift Pump. Write for your copy today!



CAPACITIES: 600 to 3300 Gallons per Hour from well depths to 600 feet.

Hi-Lift's pumping element is water lubricated, operates at half the usual pump speed; resists sand cutting abrasion and corrosion. When used with pressure tank, extremely high pressure may be developed without change or adjustment. These and many other Hi-Lift features are sure to make big savings in your water supply costs.

FULLY PATENTED BY R. MOINEAU & PEERLESS PATS.

fmc PEERLESS PUMP

PEERLESS PUMP DIVISION, *Food Machinery Corp.*
LOS ANGELES 31, CALIF.; INDIANAPOLIS, IND.
District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, Calif.; Los Angeles 31, Calif.

WEEDS are OUT at water works installations

DOLGE SS WEED KILLER

can be used to advantage in all areas containing water works installations, where no vegetation **whatever** is desired. Sprinkled on, in economical dilution, this formula works down to the roots, so that it destroys not only surface growth but the entire vegetable structure . . . particularly important where stand pipe locations must be considered. Keeps the growth down around high reservoirs; with proper application there is no danger that the solution will work into storage facilities.

E.W.T. Selective Weed-Killer

(2-4-D) maintains your landscaping but eliminates noxious weeds. Non-injurious to most grasses, E.W.T. aids in keeping a "well-groomed" appearance to the grounds around your pumping plant, purification plant, storage facilities and administration building.

Both DOLGE WEED KILLER and E. W. T. SELECTIVE WEED KILLER have their place in your ground maintenance program. They forestall hours of expensive labor devoted to weeding by "going to the root" of the weed problem.

GET ALL THE FACTS!

Write for DOLGE'S brand-new booklet

"CHEMICAL WEED CONTROL"

—Contains complete, up-to-the-minute information on how to deal with your weed problems swiftly, economically and *lastingly*.

The C. B. DOLGE CO.
WESTPORT, CONNECTICUT

MAY WE SUGGEST:—

New memo sheets for Symons (Doc)
Much bigger than his present stock
With (just to jog him as he jots)
A border of forget-me-nots.

* * *

H.T.M.A.—And this time it really is I, with my thanks to the boys and girls from Ontario. Of course I know that the material was edited by Ye Royal Scribe, one G. A. H. Burn, whose nickname "Weary" has been added to my collection. I suspect that the Pied Piper is A. V. (Cap) Delaporte whose wife Sally probably had a heavy hand in the writing. No doubt the introductory verse was whipped up by Helen (Mrs. O. V.) Ball, she of the really wonderful poetical ability when she turns a hand to it. And I presume that I must thank Fran (Mrs. Geo. M.) Galimbert, she of the ready wit, for the item about the dancing teacher.

Sorry kids, space limitation this month makes it necessary to delete a portion of the material on the A.W.W.A. Convention, which I suspect "Bert" Berry had a hand in writing and which I shall run with my August Column. That will complete "my" story of the Atlantic City Meeting. See you all next month—after a vacation—I hope. V.T.Y.—Doc.

FREE WRITE FOR THIS BOOK BY DR. HALE Tells How To CONTROL ALGAE

• • • AN AUTHORITATIVE WORK CONCERNING THE CONTROL OF MICRO-ORGANISMS AND ELIMINATION OF TASTES AND ODORS. This enlarged edition, by Dr. Frank E. Hale,* describes in detail methods of controlling various forms of microscopic life commonly dealt with in water supply systems. Descriptive material includes 48 clear photo-micrograph studies of organisms discussed. . . . Many of the most important water works specify Nichols *Triangle Brand* Copper Sulphate. Triangle Brand is available in several convenient sizes for water treatment. Write *today* for details and book.

*(Director of Laboratories, Dept. of Water Supply, City of New York)

THE STANDARD FOR OVER 50 YEARS

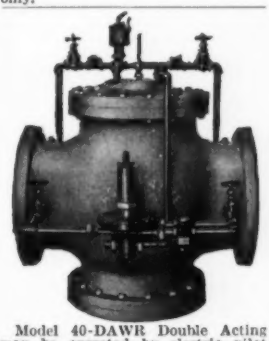
NICHOLS TRIANGLE BRAND COPPER SULPHATE 99% + PURE

MADE BY
PHELPS DODGE REFINING CORPORATION
Electrolytic Refiners of Copper
40 Wall Street, New York 5, N. Y.
230 North Michigan Avenue, Chicago 1, Ill.

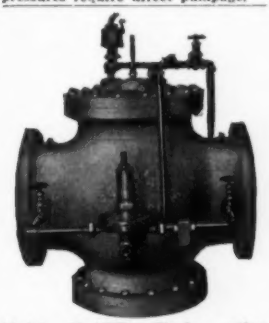
Est. 1879

ROSS AUTOMATIC VALVES

Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

ROSS VALVE MFG. CO.
Incorporated
P.O. BOX 595, TROY, N.Y.

[Overflow from the main section]

Dr. George A. Soper Dies

Noted Engineer Traced Typhoid Mary

Dr. George A. Soper, one of the early and leading sanitary engineers of this country, died recently at the age of 78. Dr. Soper was probably best known for his work in tracing the 1904 typhoid outbreaks to "Typhoid Mary" Mallon, and his work in rehabilitation of Galveston, Tex., after the storm of 1900, and for his work on cancer.

Beginning his work at the Boston Water Works after receiving a B.S. from Rensselaer Polytechnic, and an A.M. and Ph.D. from Columbia, Dr. Soper was later made sanitary engineer of the New York City Health Dept. As Commissioner of the Metropolitan Sewerage Commission, Dr. Soper drew the early plans for a comprehensive plan of sewage disposal for New York, and later did the same for the City of Chicago. Other outstanding jobs included the study of the ventilating system of the New York City subways, and a study of ice flow in the Atlantic Ocean (after the 1912 Titanic disaster). From 1923 to 1928, Dr. Soper was managing director of the American Society for the Control of Cancer.

Wm. Denise Enters Contracting Business

Wm. D. Denise, Supt. of Sewage Treatment of the Town of Greece (outside Rochester, N.Y.) for eleven

years, and Supt. of Water for the past five years, has resigned these positions to enter the field of general contracting. In Mr. Denise's new association he will maintain contact with the fields of water and sewage works, doing plumbing, heating, and piping, including water main installation, services and repairs.

News Item

Milwaukee, Wisc.—Residents of a suburb of this city found an effective

means of protesting delays in extending sewer services to their area. The irate citizens moved outhouses from their usual inconspicuous location in the back lots to their front lawns.

In Portland, Maine they protect life and property with Mathews Hydrants—and wherever there's a Mathews there's safety plus.

In more than 75 years' record-making, Mathews Hydrants have proved as infallible as human ingenuity could make them. No water can reach the operating thread to rust it or deposit sand. The operating nut is securely shielded against rain, dust and dirt. No ice can form—even in coldest weather. The drain valve is positive and automatic, the main valve true compression-type. All the working parts are housed in a removable barrel, which can be replaced in a few minutes—minutes that could *count*.

There are over 400,000 of these great hydrants in the world today. Send for our illustrated booklet giving the facts in detail. Give your community the extra safeguard of Mathews Hydrants.

OTHER MATHEWS FEATURES: Head can be rotated 360° • Replaceable head—nozzle outlets easily changed • Nozzle levels raised or lowered—no excavating • Stuffing-box plate integral with nozzle section—strong, safe, leakproof • Bronze stop nut to halt downward travel of stem • Only one part to oil—the operating thread

MATHEWS HYDRANTS

Made by R. D. WOOD COMPANY

Public Ledger Bldg., Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

REA
WA

READER SERVICE CARDS for

WATER & SEWAGE WORKS

Equipment — Products
Information — Literature

JUST
CLIP
THESE
CARDS
MARK
AND
MAIL —
TO
RECEIVE
THE
LATEST
INFORMATION
OR
LITERATURE
DESCRIBED
IN
THIS
ISSUE

Place Stamp Here

WATER & SEWAGE WORKS
155 East 44th Street
New York 17, N. Y.

Reader Service

Place Stamp Here

WATER & SEWAGE WORKS
155 East 44th Street
New York 17, N. Y.

Reader Service

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

A sear
the pol
act wh
Sale" r
a lot.
Usu
proach
say "n
in this
and th
attenti
crying

MA

R
Mai
velo
the
actu
V
or
the

o
t
u
u

A search of the local ordinances by the police could find no councilmanic act which prescribed that the "Chic Sale" must be located on the rear of a lot.

Usually when a citizen is approached by the police, he is apt to say "no offense intended, officer", but in this case, offense to both the eye and the nose was calculated to call attention of the city fathers to the crying need for sewer service.

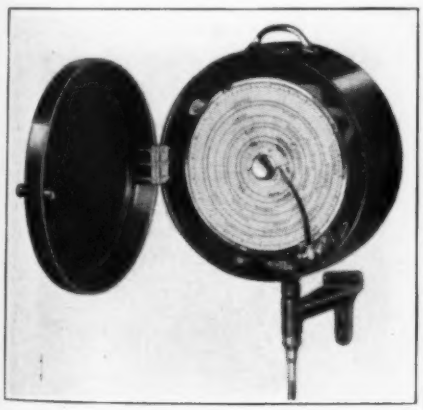
MANUFACTURERS' and EQUIPMENT NEWS

700

Portable Flow Recorder

R. W. Sparling Co., 945 North Main St., Los Angeles, Calif., has developed a unique instrument called the Portable Metrograph to record actual water usage on any service.

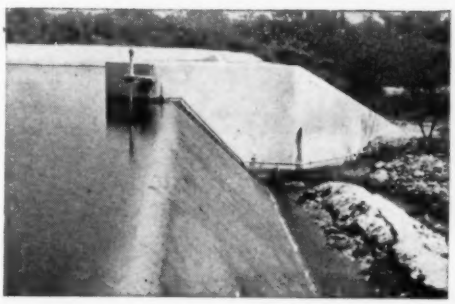
Where meter operation is in doubt, or where customers complain that their meter reading can not be right,



or in any situation where it is desired to have an actual record of the water used and the times at which it was used, this instrument is ideal.

Shown in the accompanying photograph, this device is attached by means of the downward cable to the meterhead of any volumetric meter. The totalizer on the meterhead is removed temporarily and a register behind the chart on the Metrograph does its work.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



DAM REBUILT WITH "GUNITE"

This is Lower Doughty Pond Dam belonging to the Atlantic City, New Jersey, Water Department, a poured concrete structure with fresh water upstream and tide water at the downstream toe. This structure became seriously disintegrated and eroded as shown in the upper photo, and was completely restored with "GUNITE" a minimum of six inches in thickness with double mesh reinforcement.

The lower view shows the finished job completed by us in 1941. Both the upstream and downstream faces were restored with "GUNITE", as well as the wing walls.

Our 72-page general bulletin C2300 describes this and scores of other uses of "GUNITE". We shall be glad to send it to you upon request.

MANUFACTURERS OF THE "CEMENT GUN"

84" pipe—Spring Lake, N. J.

FLANGED PIPE
FLEXIBLE JOINT PIPE
BELL & SPIGOT PIPE
SPECIAL CASTINGS
SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2 TO 84

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

The pen arm is guided by a continuous groove in the back of the chart plate so that the continuous line on the chart, roughly seven circles, gives a picture of the flow during seven days. Circular sweeps are made when there is no flow; each up and down marking on the chart records a definite quantity of water passing through the meter. No electric connection is needed. Light in weight, completely portable, and accurate, this Portable Metrograph gives a complete record of water usage for a week.

For further information, fill in a Reader Service Card with the above key number and mail to this magazine.

701

Resin Ion Exchange

The Resinous Products & Chemical Co., Philadelphia 5, Pa., has introduced a new high capacity bead-type resin for ion exchange processes. The new resin is named Amberlite IR-105 and has an exchange capacity in the sodium cycle of 14,000 grains per cu. ft.

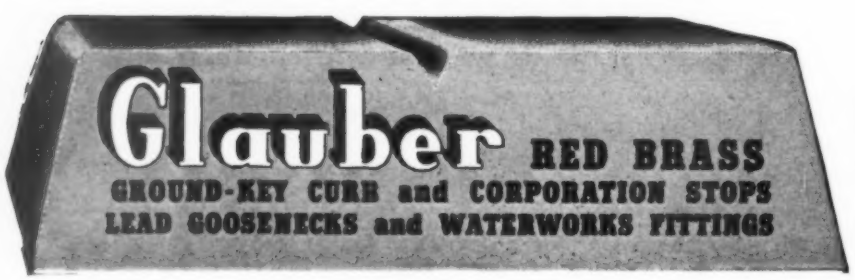
Among the advantages claimed for this new material are (1) smooth spherical shape; (2) freedom from odor, taste, and color-throw; (3) uniform particle size; (4) higher density; (5) rugged physical properties, and (6) high exchange capacity at efficient regeneration levels.

For further information on this new resin for ion exchange, enter the above key number on a Reader Service Card, and mail.

SPECIFY Glauber
WATER LINE
CONNECTIONS
"They stand the
tests of time"
K-1420 — Inverted Key Curb Stop with loose tee handle. Round way, for copper service pipe both ends.
K-1038 — Inverted Key Curb Stop with loose tee handle. Round way, inside iron pipe threads with top threaded for service box.

When Glauber water line connections are put into the ground, they are there to stay. Eliminate costly "opening up" for replacements by always specifying Glauber. For a lifetime of trouble-free operation you can't beat Glauber Red Brass ground key work.

THE **Glauber** BRASS MFG. CO., KINSMAN, O.
Division of H. B. SALTER MFG. CO., Marysville, Ohio



Joe Wafer Vice Pres. W. Va. Pulp & Paper

Joe Wafer, general manager of the Industrial Chemical Sales Div., has been elected a vice president and director of the West Virginia Pulp & Paper Co.

Mr. Wafer has been active in the chemical field since 1917 and first became associated with the company in 1924. He has been general manager of the company's Chemical Sales Division since December 1943.

702

Valve and Curb Box

Verako Products Co., Grand Ave. & Skokie Road, Waukegan, Ill., has announced that it is now marketing G-H shock-proof valve and curb boxes made of asbestos cement pipe with cast iron tops and covers.

These G-H shock-proof valve and curb boxes were first described in this magazine in December, 1946. The box was developed by Clarence Greutzmacher, engineer of distribution, and Otto Halvorsen, assistant mechanical engineer, of the Milwaukee Water Department.

This novel shock-proof box has rubber rings and gaskets on a telescopic cylinder. The upper cylinder slides inside of the lower cylinder, with the rubber rings between.

For further information on this product, enter the above key number on a Reader Service Card, and mail.

HYDRANTS and VALVES

Expert workmanship and highest quality materials make M & H products a good investment always. Many years of use in all sections of the country has proved their ruggedness and dependability.

M & H furnishes both regular type A.W.W.A. fire hydrants and special Traffic Model designed to yield at the ground line under impact.

Write for Catalog No. 34

M & H PRODUCTS
Fire Hydrants
Gate Valves
Tapping Valves
Special Castings
Tapping Sleeves
Check Valves
Floor Stands
Extension Stems
Mud Valves
Flap Valves
Sludge Shoes

M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

Pitometer Chicago Office Moves

Cyrus R. Bird, Vice Pres. and Western Manager of The Pitometer Co., Chicago, Ill., has announced the removal of the Chicago office to new and larger quarters. The new address is Room 1336, 122 S. Michigan Ave., Chicago 3, Ill.

703

Corrosion-Resisting Axial Flow Pump

Economy Pumps, Inc., Hamilton, Ohio, has introduced a large capacity axial flow pump designed to resist contaminated sea water and other corrosive liquids. The new pumps are especially suited to condenser circulation and other services requiring low cost high speed pumping of large volumes of liquids.

These pumps should find application in the industries where large volumes of cooling water are used and where it is desirable that such cooling water be separated from industrial wastes.

For further information, enter the above key number on a Reader Service Card and mail.

LEADITE
The Pioneer Self-Caulking Material for C.I. Pipe

Eliminates . . . . . Superfluous Operations in jointing cast iron water mains . . . . . .

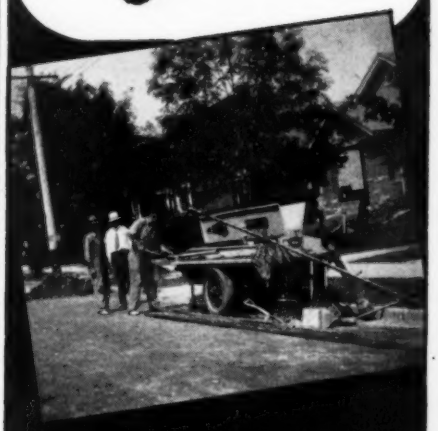
—thus permitting the work to be completed with less effort, and in less time. Leadite saves on the items of: Material costs; caulking charges; digging large bell holes and consequent reduction in cost of trench pumping; handling on the job (it's lighter); melting time and heat required (it melts at low temperature) — and Leadite improves with age.

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

PORTABLE All Steel TOOL BOX

THIEFPROOF WEATHERPROOF FIREPROOF



Littleford "Handeebox" All Steel Tool Box is constructed to trail at high speed—in addition, it is light weight, neat in appearance, sturdily built, has patented all around locking arrangement, wide working shelves on both sides, partitions and shelves for tools, etc. Gas, Waterworks, and Sewage Departments and contractors will find this "Handeebox" the low cost method of transporting valuable tools to the job —and too, the "Handeebox" can stay on the job overnight without fear of losing valuable tools. Ask for Bulletin V-6.

LB LITTLEFORD
BLACK TOP ROAD MAINTENANCE EQUIPMENT SINCE - 1900
Littleford Bros., Inc.
420 E. Pearl Street, Cincinnati 2, Ohio

704

Self-Adjusting Wrench

The E-Zee Tool Mfg. Co., 136 Liberty St., New York 6, N.Y., has announced a new automatic self-adjusting and self-locking wrench with a ratchet action. The wrench is available in two sizes, 6 in. and 8 in. The 8 in. size will take nuts from 7/16 in. to 15/16 in., thus covering practically the entire range of five open end wrenches.

The jaws of the new wrench are made from chrome vanadium drop forged steel and the handle is made from alloy steel.

If you are interested in this new self-adjusting wrench, mail a Reader Service Card on which is entered your name and the above key number.

705

Chemical Resistant Coating

Morton Chemical Co., Greensboro, N. C., has introduced the Duramite line of chemically inert paints and coating materials. These materials are characterized by good adhesion and heat resistance. They are easily applied solutions of chemically inert resins. Acids, alkalies, and most corrosive materials have no effect on these products.

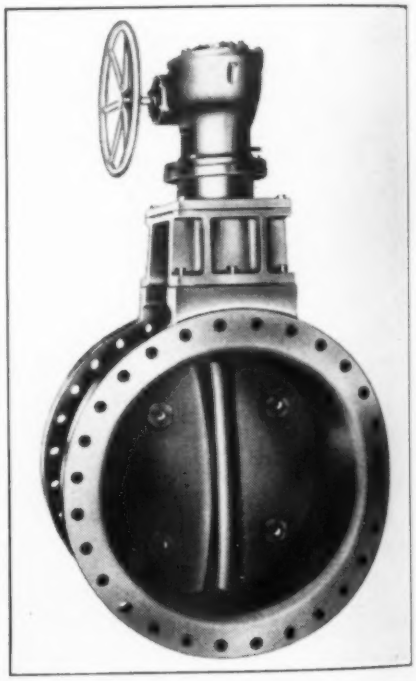
Known as Duramite TH Chemical Resistant Coatings, they maybe applied by brush, spray, or dip and can be air-dried or baked. They are used for maintenance painting in corrosive atmospheres, for masonry and concrete, and chemical resistant floor finishes. A variety of colors is available to both protect and identify equipment.

Additional information on this protective coating is available. Just fill in a Reader Service Card with the above key number and mail.

706

R-S Shut-Off Valve

Shown in the accompanying photograph is a new R-S Class B Iron Valve, Type B-9468, rated at 50 lbs. Introduced by R-S Products Corp., Philadelphia, Pa., this valve is designed for rugged hydraulic service and is equipped with the patented R-S rubber spool.



The rubber spool combined with wedge-type closure of the R-S angular seating disc provides positive shut-off for thousands of full-open-to-full closed cycles.

Although rated as a 50 lb. valve, it is claimed that the new unit will give bubble-tight shut-off up to 80 psi. and commercially tight shut-off at 100 psi.

For further information, mail a Reader Service Card on which is entered the above key number.

YOU WOULDN'T DO THIS

So

WHY BURN SLUDGE?

Turn it into an operating profit with a

ROYER Sludge Disintegrator

Do you realize . . . 1. How much profit there is in marketing Royerated sludge to farmers, florists, golf courses and parks as a topnotch soil improver . . . and, 2. How easy it is to prepare with a Royer? One or two men can handle 4 or more cu. yds. per hour . . . taking undried cake (up to 56% moisture content) direct from sludge beds, shredding it to a fine granular mixture, and discharge it directly into trucks or bags for immediate disposal. Let us send you the facts Write for Royer Sewage Sludge Catalog.

Royer Sludge Disintegrator turning waste to profit for the city of Omaha, Nebraska.

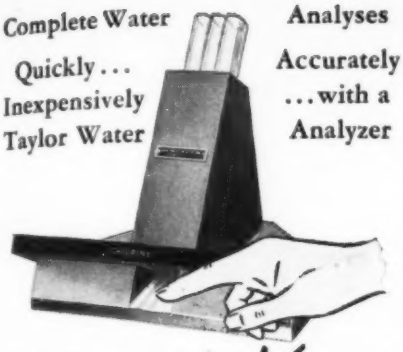
ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST., KINGSTON, PA.

Complete Water Analyses Quickly... Accurately ...with a Inexpensive Analyzer Taylor Water



There's the Value!

pH, COLOR, MANGANESE, TOTAL IRON, AMMONIA, CHLORINE, SILICA, NITRATE N, NITRITE N, FLUORIDE

The Taylor Water Analyzer is so inexpensive, and so easy to use, that even the smallest water treatment plants can make complete analyses. Nine Taylor Liquid Color Standards, a complete set for each indicator or determination, are permanently enclosed in one plastic slide, eliminating the expense and handling difficulties of single standards.

Moreover, Taylor Color Standards carry an unlimited guarantee against fading. All necessary slides fit the one base.

FREE—INFORMATIVE BOOKLET!

Write direct for "MODERN pH AND CHLORINE CONTROL"—96 pages of valuable data for all men concerned with water purification problems. Tells how Taylor sets make determinations easily, simply, quickly. Illustrates and describes all Taylor sets. See your dealer for equipment.

W. A. TAYLOR AND CO.
7308 YORK RD. • BALTIMORE 4, MD.

O'Grady Named Pittsburgh Equitable District Supervisor

Joseph O'Grady has been appointed district supervisor of Water Meter Sales for the Pittsburgh district office of the Pittsburgh Equitable Meter Div., Rockwell Mfg. Co.

Mr. O'Grady has been connected with water meter sales for the company during the past seven years, operating out of headquarter offices. Before that he was associated with the Iroquois Gas Co., Buffalo, N.Y. In his new position he will supervise meter sales in Pennsylvania, West Virginia, Ohio, Maryland, and Delaware.

No point in jointing cast iron water mains with HIGH PRICED LEAD!

Switch to

Haymanite JOINTING COMPOUND

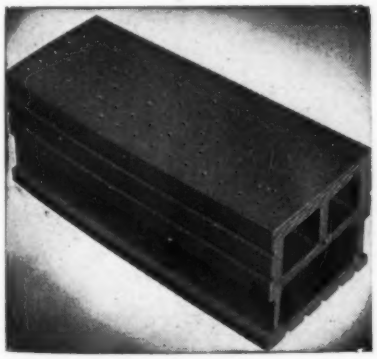
- Saves 75% of costs
- Goes 4 times as far
- Eliminates caulking
- Needs no large bell holes
- Self-seals if broken

Once Haymanite is used for a bell and spigot cast iron water main installation, you'll never want to go back to lead or any other material. Aside from its tremendous cost-saving features, Haymanite is easily applied by any workman and requires fewer tools. Immediate shipment. FREE: Illustrated catalog.

MICHAEL HAYMAN & CO.,
INCORPORATED
ESTABLISHED 1869
870 EAST FERRY ST. BUFFALO, N. Y.

Leopold

GLAZED FIRE CLAY TILE FILTER



• Permanent • Non-corrosive • Economical • Impervious to acid or alkali solutions • Practically non-absorbent • Equal distribution.

Complete water purification and sewage plant equipment.

Write today for complete information

F. B. LEOPOLD CO., INC.
2413 W. CARSON ST. PITTSBURGH 4, PA.

FOR BETTER
pH Control and WATER TESTS
there is nothing like

NON-FADING GLASS COLOR STANDARDS

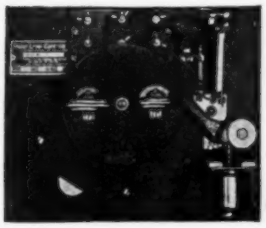
Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

HELLIGE
INCORPORATED
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

ROTO-TROL



"A" TYPE

Type "A" Roto-Trol operates from the pressure in the pump discharge line, at the pump house. The electric time delay prevents starting or stopping due to surges. It also protects deep well turbines from damage due to back-spin . . . *Type "A" Multi-Pump Roto-Trol* is designed for two or more pumps discharging into the same discharge pipe. Adjusted time delays compensate for additional pumping friction and surges when second pump starts or stops.

WRITE FOR PERFORMANCE AND ENGINEERING DATA

Water Levels Control Division
HEALY-RUFF COMPANY
783 HAMPDEN AVE., ST. PAUL 4, MINN.

C. H. Irwin Heads Infilco's Pittsburgh Office

Clyde H. Irwin has been assigned as field engineer in charge of the Pittsburgh office of Infilco, Inc.

Prior to association with Infilco, Mr. Irwin was senior chemist at the Baldwin Filtration Plant, Cleveland, O., for 13 years. In 1943 to 1946 he was research assistant and research associate at the Case School of Applied Science. For his work at Case on the problem of detecting and eliminating contamination in military water supplies, Mr. Irwin was awarded a Certificate of Merit by the National Defense Research Committee.

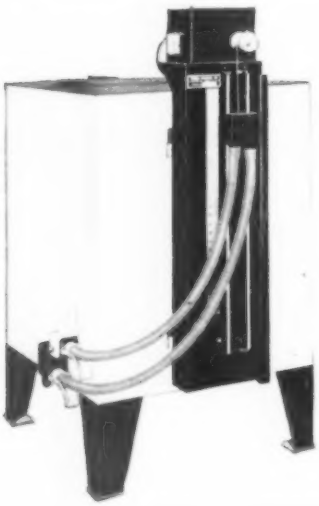
National Water Main Cleaning Moves Chicago Office

The Chicago office of the National Water Main Cleaning Co., under the management of James R. Brown, Vice Pres., has moved from its W. Wacker Drive office to a new office located at Room 1336, 122 S. Michigan Ave., Chicago 3, Ill.

OMEGA
PRECISION SOLUTION
FEEDER

The Omega Precision Solution Feeder is a real find for water works men. Accurate within 1%, it automatically feeds by gravity, solutions of hypochlorite, copper sulphate, ammonium sulphate, polyphosphates, etc. It has no valves, diaphragms, or pump. Its simple operating principle assures true volumetric measurement. The feeding mechanism — adjustable by a dial having 100 graduations — is driven by a small synchronous motor. Where electricity is not available, an eight-day clock movement drives the mechanism. Standard tank capacities range from 50 to 200 gals. with feeding rates from .08 to 32 g.p.h. Special units feed to 200 g.p.h.

WRITE FOR BULLETIN 9-12



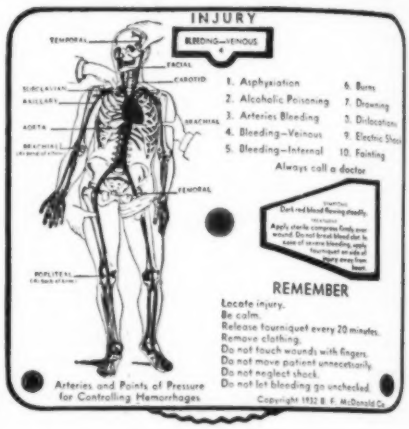
OMEGA PRODUCTS
Volumetric Feeders • Gravimetric Feeders
Solution Feeders • Lime Slaking Equipment
Bucket Elevators • Laboratory Stirrers

OMEGA MACHINE COMPANY
(Division of Builders Iron Foundry)
10 CODDING STREET, PROVIDENCE 1, RHODE ISLAND

707

First Aid

Davis Emergency Equipment Co., 45 Halleck St., Newark 4, N.J., has available a handy chart with rotating disc to give directions for first aid at a glance. Some 20 different accidents



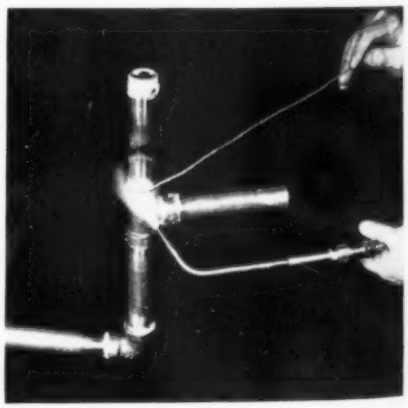
and their symptoms, and treatment are given in this handy unit which carries the number 369 and the title **Insta-Aid.**

If you are interested in this pocket-size chart, just fill in a Reader Service Card with the above key number and mail it to this magazine.

708

Bronze Threadless Fitting

Following the introduction of the Flagg-Flow, first threadless malleable iron fitting, the Stanley G. Flagg & Co., Inc., Philadelphia, has now introduced the same threadless fitting in



I.P.S. brass and copper pipe or tubing. The fittings are Flagg-Flow bronze fittings.

These Flagg-Flow bronze fittings meet the increasing demand for one-piece brass, copper pipe, or copper tubing. They are threadless bronze pipe fittings for brazing to I.P.S.

HYDRO-TITE
JUST POUR
THAT'S ALL

Hydro-tite, the self-caulking, self-sealing, pipe-jointing compound, solidifies and hardens immediately without shrinkage. No caulking is necessary. Any slight seepage that may appear at first soon stops.

For over thirty years Hydro-tite has proved its ability to stand up under all conditions of strain, vibration and pressure. Send for data book and sample.

ALWAYS USE FIBREX

The sanitary, bacteria-free packing that costs about 30% less than braided jute. Send for sample.

HYDRAULIC DEVELOPMENT CORPORATION
Main Sales Office: 50 Church St., New York, N.Y.
Works: West Medford Station, Boston, Mass.

brass or copper base alloy tubing or pipe, and the one-piece system resulting is as strong as the pipe itself. It may be applicable for 150 lb. working steam pressure at 450 deg., F., or 300 lb. non-shock cold water, oil, or gas lines.

Further information on this new fitting may be obtained by entering the above key number on a Reader Service Card and mailing same to this magazine.

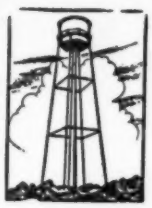
709

Dry Rustproof Coating

Kano Laboratories, 75 W. Wacker Drive, Chicago 1, Illinois, have developed a new rust preventive, consisting of a thin, clear film, deposited on metal surfaces. Sold under the name of Kano Rustproof, it is applied by cold dipping, spraying or brushing and dries in about 15 minutes to a clear, hard, dry surface.

The material may be removed with any petroleum solvent, although it is not necessary to remove it prior to painting. It is tough, flexible and nonporous and is available in packages from one to 55-gallons.

For further information, enter the above key number on a Reader Service Card and mail.



SERVICING
FEDERAL
STATE
COUNTY
MUNICIPAL
AND
INDUSTRIAL WATER TOWERS
SPEELMON ELEVATED TANK—SERVICE
COMPLETE PAINTING AND REPAIR SERVICE
822 N. Court St. Rockford, Ill.

MACHINE BLENDED
BOND-O

A dependable self-caulking joint compound for cast iron bell and spigot water mains.

Used by hundreds of water companies—water departments and water works contractors.

NORTHROP & COMPANY, Inc.
SPRING VALLEY, NEW YORK

Stop Rust on Gear Trains in Storage

DIP gear trains and other meter parts in Oakite Special Protective Oil, to cover surfaces with the thin transparent film that locks out rust. You can hold such parts in rust-free storage condition indefinitely. Specify Oakite Special Protective Oil today.

FREE 16-page Oakite booklet gives full details. Send for your copy today!

OAKITE PRODUCTS, INC.
73 Thames Street, NEW YORK 6, N. Y.
Technical Representatives in Principal Cities of U. S. & Canada

OAKITE
Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

FEED-METERS-MIXES CHLORINE GAS ACCURATELY

PURIFICATION FOR WATER-SEWAGE & SWIMMING POOLS

Everson SterElators Operate Manually or Semi-Automatically, Also Automatically Proportion Gas Flow to Water Flow.

Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

All SterElators Are Dependable, Accurate, Safe and Easy to Operate. Guaranteed to Give Complete Satisfaction. NO JOB TOO LARGE

Send us Copy of Specifications

SterElators by Everson

EVERSON MFG. CORP.
233 W. Huron Street
Chicago 10, Ill., U. S. A.

BAILEY METERS AND CONTROLLERS
FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

BAILEY METERS

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY
1072 IVANHOE ROAD • CLEVELAND, O.
Bailey Meter Co. Ltd., Montreal, Canada

EDSON
DIAPHRAGM PUMPS

Hand Sizes 2", 2½", 3", 4"
Power Sizes 3" and 4"
Open Discharge or Force Pump
Edson Special Suction Hose
Red Seal Diaphragms
Strainers and Foot Valves
Hose Spanners—Adapters

THE EDSON CORPORATION
Main Office and Works: 49 D St.
South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

Beckman Instruments Has Chicago Service Office

Beckman Instruments, produced by National Technical Laboratories, now have a factory servicing headquarters at 9 S. Clinton St., Chicago, Ill.

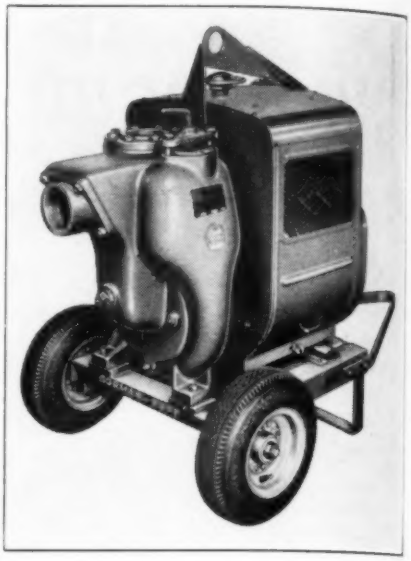
George R. Kinkaid, mid-western representative for National Technical Laboratories, is in charge.

The new Chicago Service and Repair Department is equipped for servicing and repairing Beckman pH meters, spectrophotometers, radiation meters, glass electrodes, and other Beckman precision control instruments.

710

Self-Priming Contractors' Pumps

Gorman-Rupp Co. of Mansfield, Ohio, has introduced a complete new line of Gorman-Rupp Centrifugal Self-Priming Contractors' Pumps. According to the company engineers, "the self-priming feature has reached its highest achievements" in these new pumps. This patented design incorporates quick positive priming features without the use of valves, vents, or any mechanical devices.



For further information on these self-priming contractors' pumps, enter the above key number on a Reader Service Card.

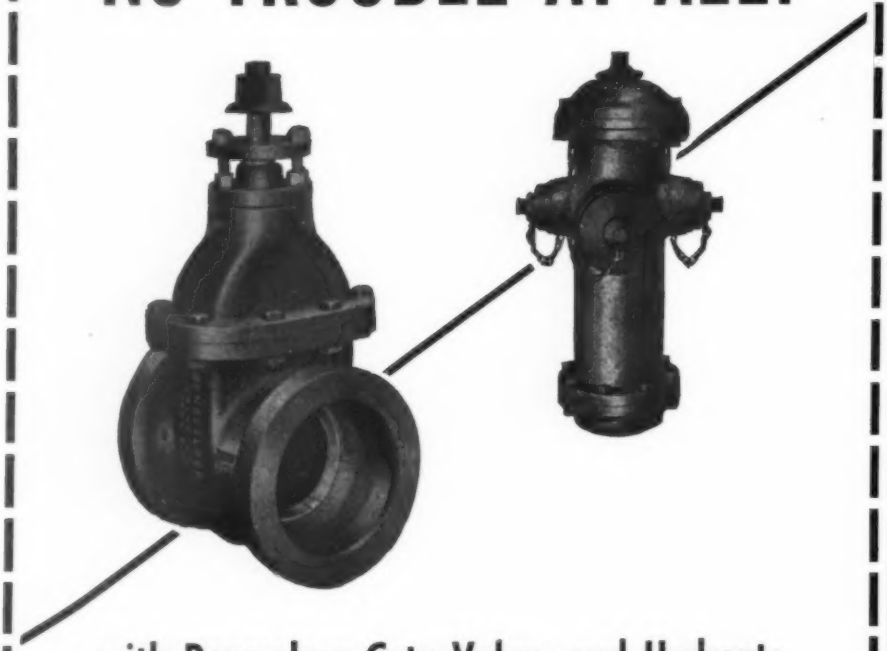
711

Pneumatic Sponge Pump

Developed by the Pump Division of the Byron Jackson Co., Los Angeles, Calif., a pneumatic sponge pump is offered as a highly adaptable unit for high head "mopping up" in mine shafts, coffer dams, caissons, sumps, tanks, basins, bilges, and manholes.

This pump will handle sand and pulverized rock and solids up to ⅝ in., and its lowest operating liquid level is within three inches of the base of the pump. It can be furnished in single stage and two stage construction.

"NO TROUBLE AT ALL!"



with Rensselaer Gate Valves and Hydrants

That is what satisfied users of Rensselaer Gate Valves and Hydrants tell us year after year. If you want the same trouble-free service, always specify Rensselaer.

For complete details get in touch with your nearest Rensselaer factory-trained representative or write to Rensselaer Valve Company, Troy, N. Y.

RENSSELAER VALVE CO.

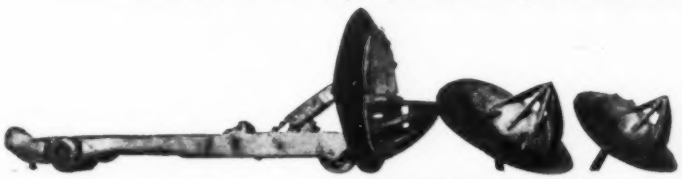
Ask the man who uses Rensselaer!

TROY, N. Y.

The SEWER SCOOTER

(U. S. Patent 2,198,823)

THE ONLY 100% SELF-PROPELLING SEWER CLEANER



THE FLUSHING ACTION IS APPLIED BY COLLAPSING THE SHIELD.

A patented feature

No Preliminary Work—
Gets Results in a Hurry

SEWER SCOOTER MODEL A-3, BRONZE

Standard machines stocked 8 inches to 96 inches—For sale, rent or contract.

J. C. FITZGERALD

Box 289-A
Coral Gables 34, Fla.

The pneumatic sponge pump is a vertical, single, or two stage unit, operated by an air motor which has a governor and variable speed control. Capacity range at 90 psi. is 25 to 300 gpm., and head range is 25 to 300 ft.

Further information is available on this unit. To obtain such enter the above key number on a Reader Service Card and mail.

712

Tuff-Bond Adhesive

The Goodloe E. Moore Co. of Danville, Ill., has developed and is marketing a new general purpose adhesive

known as Tuff-Bond. Tuff-Bond adhesive is recommended for bonding jobs in building, construction, and maintenance. It is one of the few reclaimed rubber base adhesives on the market which contains no soap, water, or asphalt, and less than one per cent sulphur.

Because of its chemical characteristics, it has a long life and resists deterioration. It has an extremely wide temperature range and may be adapted for bead or trowel application. It is waterproof, will not freeze, is resilient, and will bond practically every material found in the construction and building industry. Smears can quickly be removed with gasoline or similar solvent.

This unique adhesive should have many applications in and around both water and sewage works. For further information, enter the above key number on a Reader Service Card and mail.

Clay Products Assn. Moves

The Clay Products Association has moved to a new address. Henceforth it will be located in Room 2100 at 100 N. LaSalle St., Chicago 2, Ill.

AMERICAN GAS BOILERS

STEAM AND WATER TYPES

FOR DIGESTER HEATING

American Radiator & Standard Sanitary Corporation, Pittsburgh, Pa.

SALES OFFICES IN PRINCIPAL CITIES

FOR RATINGS AND DATA SEE OUR PAGE IN THE ANNUAL REFERENCE SECTION

AMERICAN-Standard
First in Heating and Plumbing

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • Darby, Pa.

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.

Sales Office: 140 Cedar St., New York, N. Y.
Factory: Medford, N. J.

Pioneer Producer of GREENSAND ZEOLITE MINERAL

713

New Deodorant

American Processing Co., Hippodrome Bldg., Cleveland, O., is marketing a new deodorant Odorid, which is claimed to operate on a different principle than other types of deodorants on the market today.

Odorid is an odorless powder. It gives off no chemical substances and is nontoxic, noncaustic, noncorrosive, and harmless to humans, animals, or birds. It may be safely used dry or mixed with water in restaurants, hospitals, manufacturing plants, theatres, water works, and sewage works, or any place where unpleasant odors are a problem.

For further information on this new product, enter the above key number on a Reader Service Card and mail.

Bailey Meter Opens New Office

Bailey Meter Co., Cleveland, Ohio, has opened a new branch office in Charlotte, N.C. This new office is located in Room 1004, Independence Bldg.

The new Charlotte office will be staffed by J. R. Powell, branch manager, and R. T. Cathey.

VAREC Names Klockner Eastern Sales Mgr.

The Vapor Recovery Systems Co. of Compton, Calif. has appointed Lewis W. Klockner, Jr. as eastern

sales manager. Mr. Klockner, who is a graduate civil engineer of Lafayette College, served as a Captain in the Sanitary Corps during the war and was a sanitary engineer for the N. J. State Dept. of Health for many years. He had previously been associated with the R. B. Carter Pump Co.

The VAREC office in New York is located at 30 Church St., New York City.

714

Shallow Well Water System

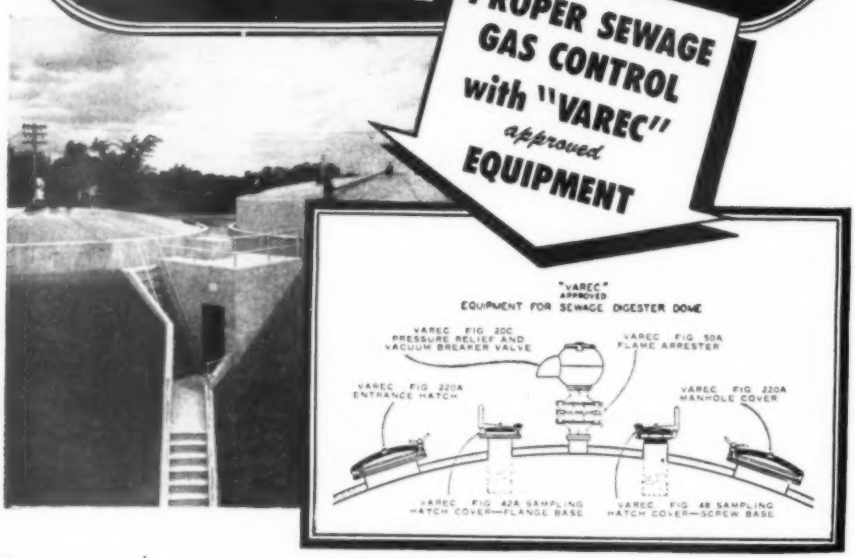
The Pomona-Westco Div. of Fairbanks, Morse & Co. has introduced

a new turbine type shallow well water system designated as Model LU-25.

This all bronze pump with rubber impeller and ¼ hp. capacitor type

DIGESTION WITHOUT EXPLOSION! . . . .

PROPER SEWAGE GAS CONTROL with "VAREC" approved EQUIPMENT


"VAREC" APPROVED
EQUIPMENT FOR SEWAGE DIGESTER DOME
VAREC FIG. 20C PRESSURE RELIEF AND VACUUM BREAKER VALVE
VAREC FIG. 50A FLAME ARRESTER
VAREC FIG. 220A ENTRANCE HATCH
VAREC FIG. 220A MANHOLE COVER
VAREC FIG. 42A SAMPLING HATCH COVER—FLANGE BASE
VAREC FIG. 48 SAMPLING HATCH COVER—SCREW BASE

GAS given off during digestion is generally 60 to 78% methane, which is explosive when mixed with between 8 to 19 times its volume of air. Hydrogen sulphide is usually present in sufficient quantities to cause greater hazards. Explosive mixtures in the tops of sewage digesters can and have resulted in dangerous explosions. But if proper precautions in handling these gases are observed there need be no hazard about digestion plants.

The Vapor Recovery Systems Company manufactures approved gas control equipment that is known throughout the Sewage Industry for its safe and excellent design and workmanship. Rigid laboratory inspections and tests are made on all "VAREC" equipment to insure long trouble-free operation. If gas control is among your problems let "VAREC" engineers assist you.

Exaggerated view for illustration purposes only. "VAREC" Approved Equipment for Sewage Digester Dome—each of these items is noncorrosive, nonsparking, easy to install and foolproof in operation. Check Catalog S-3 for the sizes needed for your requirements as well as other safety equipment.

S-3

THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA, U.S.A.
"Varec"
NEW YORK 30 Church Street • CLEVELAND 1501 Euclid Ave. • CHICAGO 122 So. Michigan Ave. • TULSA 533 Maye Building • HOUSTON 821A M. & M. Bldg.
Available from Authorized Sewage Equipment Agents throughout U. S. and Canada
Cable: VAREC COMPTON (all codes)

motor is but 19 in. high, 14½ in. wide and 11 in. in depth.

Weighing but 53 lbs., and being of small size with 3½ gal. top-mounted pressure tank, this unit can easily be installed in any house not equipped with municipal water service.

For further information, fill in a Reader Service Card with the above key number and mail.

Philadelphia Quartz Co. Moves Offices

Philadelphia Quartz Co., manufacturers of silicates of soda, has announced the removal of its general offices from 121 S. Third St., Philadelphia, where they have been located for almost half a century to the Public Ledger Bldg., Independence Square, Philadelphia.

LITERATURE AND CATALOGS

715

HEAVY DUTY PAINTS

American-Marietta Co., 43 E. Ohio St., Chicago 11, Ill., are makers of the Valdura heavy duty paints which they offer for industrial maintenance and which they describe in a bulletin for the sewage disposal industry called **Industrial Maintenance Series No. 2.**

Protective coatings for preserving the various materials and equipment in and around the sewage treatment plant are important to all sewage works superintendents, operators, and managers. This bulletin is directed especially to the attention of these men and discusses the maintenance problems of sewage disposal plants.

Of particular interest to all persons concerned with the maintenance of such plants is a blueprint for maintenance plan which consists of a large selector, showing the surface to be painted, the paint to be used for primers, and the finished coat recommended. Recommendation is given as a result of an extensive study of the painting problems encountered in sewage disposal plants, and the completeness with which these tables are developed for the selection of various paint products for use on various types of surfaces is a tribute to the thoroughness of the company in the preparation of the catalog.

Although this very interesting and highly usable bulletin is directed to the attention of sewage treatment works, the information contained therein is also applicable to many water purification plants and this bulletin will be interesting to waterworks operators as well.

To obtain a copy of this bulletin on paints and maintenance painting, enter the above key number on a Reader Service Card and mail.

716

LIME SLAKER

The Dorr Co., 570 Lexington Ave., New York, has issued a 4-page folder, Bulletin No. 7281, on **The Dorrco Slaker.** This is a self-contained unit for continuous lime slaking and the washing and removal of grit.

The catalog contains pictures and drawings of the slaker, tells what it is, how it works, and gives information on operating practice as well as advantages for the machine.

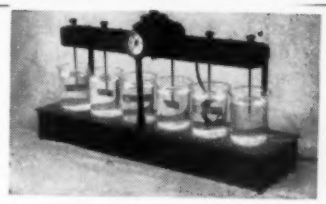
A copy of this bulletin may be obtained by entering the above key number on a Reader Service Card.

PORTABLE GATE OPERATORS

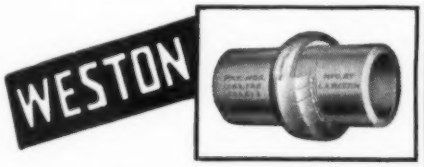
A COMPLETE LINE OF GATE OPERATORS THAT WILL SAVE ENDLESS TIME IN THE OPERATION OF GATE VALVES. FOR MOUNTING ON SERVICE TRUCKS AND SPECIAL CHASSIS PORTABLE UNIT SHOWN USES 2 HP. GASOLINE ENGINE, WEIGHS ONLY 30 LBS.

PAYNE DEAN & CO.
MADISON, CONN.

REPAIR and SAVE
Water Meter Measuring Chambers
with the
MEMPHIS SLOT INSERT
of stainless steel with new bronze thrust roller.
For further information and *free* 5/8" samples
address
METER SPECIALTY CO.
1332 N. Seventh St. Memphis, Tenn.



Phipps & Bird
LABORATORY MIXER
IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC. Richmond, Va.



GASKET AND FORM
The Perfected Method for Making Sewer Pipe Joints of Cement
- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON Adams, Mass.

ANTHRAFILT
Trade Mark Reg. U. S. Patent Office
A Filter Medium For All Purposes
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.
All correspondence regarding sales and engineering should be addressed to:
PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

717

METER SLOT INSERT

The Meter Specialty Co., Sterick Bldg., Memphis, Tenn., has recently issued a small leaflet to describe the **Memphis Slot Insert.**

This stainless steel Memphis slot insert is an efficient and economical means of reclaiming water meter measuring chambers when wear or corrosion has caused the thrust roller slot to become ragged. The use of these slot inserts saves measuring chambers and increases revenue, according to the folder. Data and information are given on operation of two meters before and after use of the slot insert.

This Memphis slot insert was developed by C. M. McCord, Dir. of the Water Division, City of Memphis.

To obtain a copy of this leaflet, enter the above key number on a Reader Service Card.

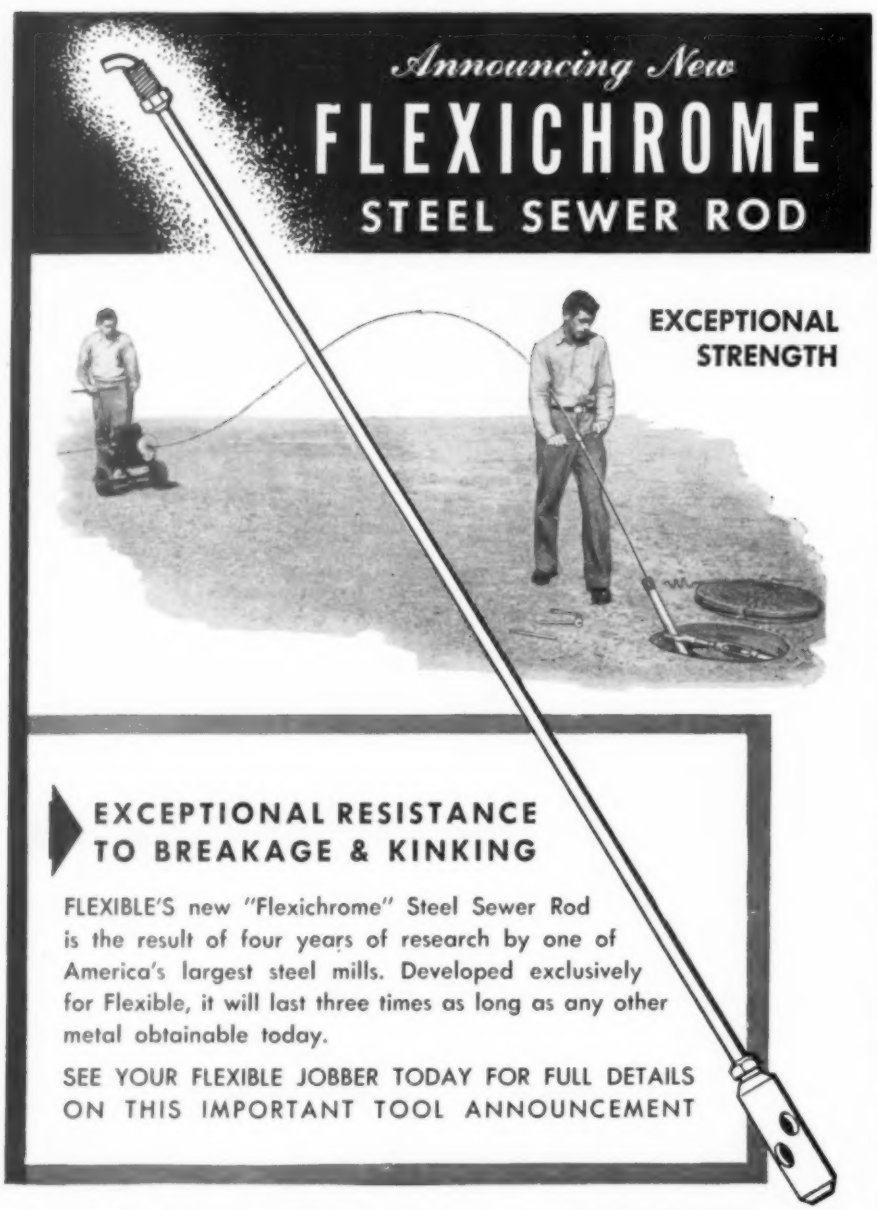
718

AIR COMPRESSORS

The Jaeger Machine Co., 550 W. Spring St., Columbus 16, Ohio, has just released two bulletins. These are No. C-160-8 covering the Model 160 **"air plus" compressor,** and Bulletin 6JC-7 on Model 600 **portable compressor.**

In the February 1948 issue of *Water & Sewage Works* there appeared an article on air compressors and their many, many uses in and around water and sewage works as indicated by a survey of our readers. When one considers these many uses of air compressors, as indicated in that article, it is apparent that these bulletins on air compressors will be of interest to all water and sewage works men.

To obtain a copy of these two bulletins, enter the above key number on a Reader Service Card and mail.


Announcing New
FLEXICHROME
STEEL SEWER ROD
EXCEPTIONAL STRENGTH
EXCEPTIONAL RESISTANCE TO BREAKAGE & KINKING
FLEXIBLE'S new "Flexichrome" Steel Sewer Rod is the result of four years of research by one of America's largest steel mills. Developed exclusively for Flexible, it will last three times as long as any other metal obtainable today.
SEE YOUR FLEXIBLE JOBBER TODAY FOR FULL DETAILS ON THIS IMPORTANT TOOL ANNOUNCEMENT

FLEXIBLE SEWER-ROD EQUIPMENT CO.

9059 Venice Blvd., Los Angeles 34, California

141 W. Jackson Blvd. Chicago, Ill.
401 Broadway New York 13
147 Hillside Ter. Irvington, N. J.
P. O. Box 165 Atlanta
2011 Central Ave. Memphis, Tenn.
801 E. Excelsoir Blvd., Hopkins, Minn.
29 Cerdan Ave. Roslindale 31, Mass.
P. O. Box 694 Pittsburgh
P. O. Box 447 Lancaster, Texas
41 Greenway St. Hamden, Conn.

719

INDUSTRIAL WASTE BULLETIN

Here is something that all sewage works superintendents, operators, engineers, and chemists will want. Something, too, that all persons engaged in industrial waste treatment should have. It is a new 32-page bulletin published by the National Lime Association, 927 Fifteenth St., N.W., Washington 5, D.C.

This booklet known as Trade Waste Bulletin No. 1 is titled **"The Use of Lime in Industrial Trade Waste Treatment".** It describes the various applications of lime in the treatment of different trade wastes and includes a reference bibliography.

If you want a copy of this bulletin, which is free, just enter the above key number on a Reader Service Card and mail the card properly filled in to this magazine.

720

WATER SOFTENERS AND DEALKALIZERS

The Permutit Co., 330 W. 42nd St., New York 18, N.Y., has prepared and issued Bulletin No. 2418 on the **Permutit Zeo-Karb Water Softeners and Dealkalizers.**

This is a 12-page bulletin which describes the Zeo-Karb double-duty water softener and dealkalizer, tells how it works, and gives advantages of its operation both for the removal of sodium or for operation on the hydrogen cycle. The book is well illustrated with diagrams of installations for various purposes. One section of the bulletin is devoted to typical analyses of boiler feedwater treatment and varied industrial applications. Another section shows actual installation of these units.

A copy of this bulletin is obtainable on request. Simply mail a Reader Service Card with the above key number.

721
TRANSITE WATER MAIN REPRINT

In the November 1947 issue of *Water & Sewage Works* appeared an article by W. D. Hurst, City Engineer of Winnipeg, Manitoba, on "Performance Record of 14-Year Old Transite Water Main at Winnipeg."

This article has been reprinted by Johns-Manville of Manville, N.J., and a copy of the reprint may be obtained by entering the above key number on a Reader Service Card.

722
VALVE BOXES

Valveco Ltd., 57 William St., New York 5, N.Y., has a 4-page folder on **Valve Boxes** made from Orangeburg fibre pipe. This pipe is manufactured by the Orangeburg Mfg. Co., Orangeburg, N.Y.

The valve boxes consist of metal covers and cover frames of cast iron construction with the tubes made of Orangeburg fibre pipe.

The folder on these valve boxes gives a general description, availability, discusses the installation, handling, and the lifetime properties of this material.

A copy of this bulletin, which describes these two-piece sliding type valve boxes, may be obtained by entering the above number on a Reader Service Card.

723
CATHODIC PROTECTION

Electro Rust-Proofing Corp., Belleville, N.J., has available an interesting booklet on **Fighting Corrosion with Corrosion.**

This bulletin describes the causes of electrolitic corrosion of metal in water and sewage works equipment and describes how the cathodic protection battery may be installed to prevent such corrosion. A number of pictures of installations are shown and the whole process of cathodic protection is adequately presented in diagrams and descriptive matter.

To obtain a copy of this interesting bulletin, enter the above key number on a Reader Service Card and mail.

724
HIGH RATE FILTER EFFICIENCY

The Dept. of Public Health and Welfare of Missouri has available a limited number of bulletins on "A Study of the Effect of Sewage Distribution on High Rate Filter Efficiency".

This bulletin contains a report on the work done by W. Q. Kehr and C. C. Ruchhoft of the Missouri Dept. of Public Health, Section of Environmental Sanitation and the U. S. Public Health Service respectively.

This report covers a study of the effect of sewage distribution on the efficiency of high rate sewage filters at Neosho, Mo. It covers the operation during winter and summer conditions of two parallel filters equipped with different types of distributors.

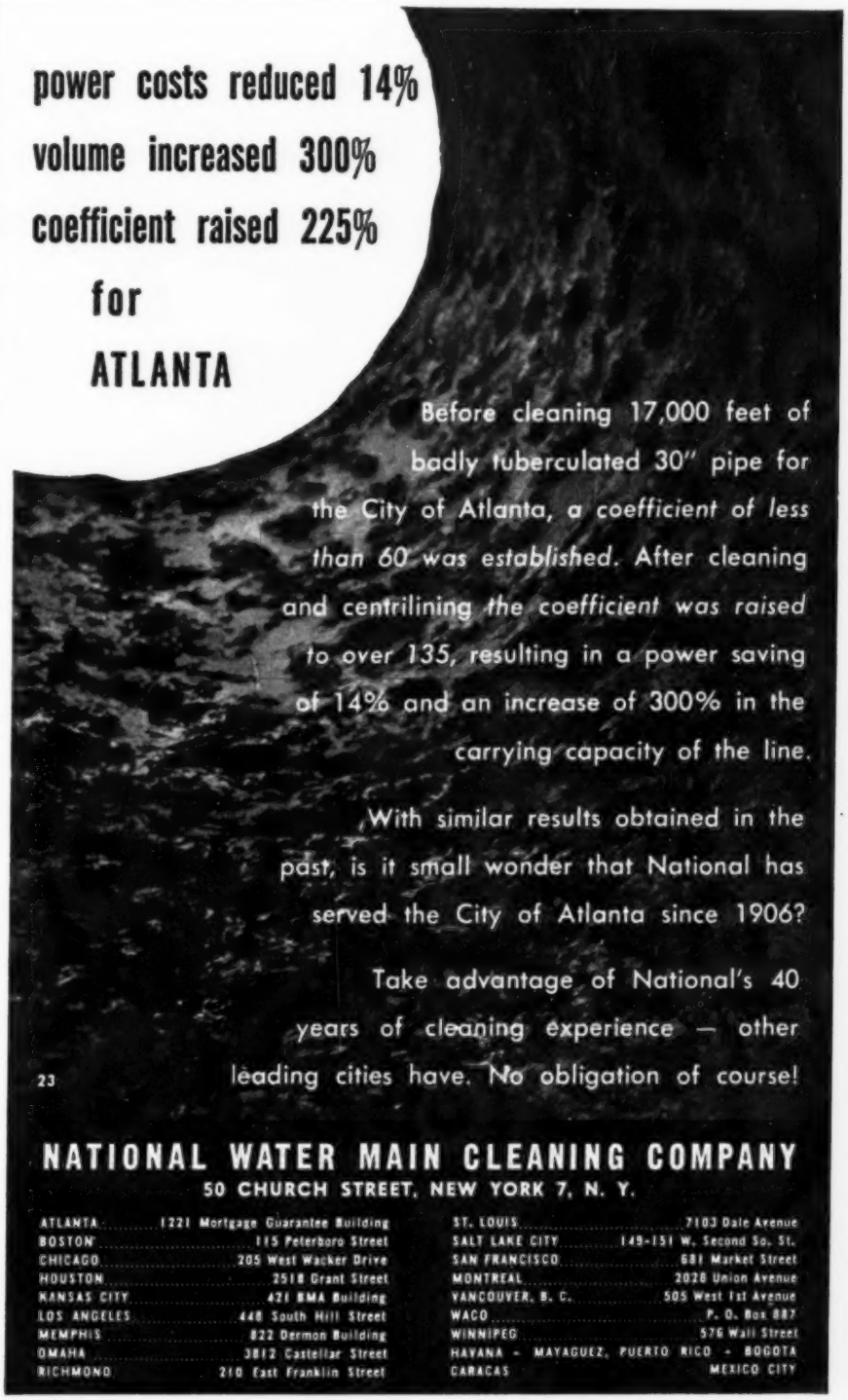
A limited number of copies of this interesting report are available. To obtain one, enter the above key number on a Reader Service Card and mail.

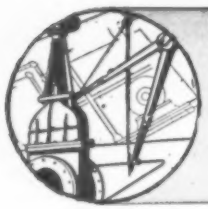
725
LABORATORY GLASSWARE

Kimball Glass Div. of Owens-Illinois Glass Co., Toledo 1, Ohio, has issued a large **Catalog of Laboratory Glassware.**

For the water or sewage works laboratory which is just being installed, or one which is in operation and desires a complete catalog of laboratory glassware available for testing equipment, this catalog is highly recommended.

To obtain a copy of this book on laboratory glassware, enter the above number on a Reader Service Card and mail.


power costs reduced 14%
volume increased 300%
coefficient raised 225%
for
ATLANTA
Before cleaning 17,000 feet of badly tuberculated 30" pipe for the City of Atlanta, a coefficient of less than 60 was established. After cleaning and centrilining the coefficient was raised to over 135, resulting in a power saving of 14% and an increase of 300% in the carrying capacity of the line.
With similar results obtained in the past, is it small wonder that National has served the City of Atlanta since 1906?
Take advantage of National's 40 years of cleaning experience — other leading cities have. No obligation of course!
23
NATIONAL WATER MAIN CLEANING COMPANY
50 CHURCH STREET, NEW YORK 7, N. Y.
ATLANTA 1221 Mortgage Guarantee Building
BOSTON 115 Peterboro Street
CHICAGO 205 West Wacker Drive
HOUSTON 2518 Grant Street
KANSAS CITY 421 BMA Building
LOS ANGELES 448 South Hill Street
MEMPHIS 822 Dermon Building
OMAHA 3812 Castellar Street
RICHMOND 210 East Franklin Street
ST. LOUIS 7103 Dale Avenue
SALT LAKE CITY 149-151 W. Second So. St.
SAN FRANCISCO 681 Market Street
MONTREAL 2028 Union Avenue
VANCOUVER, B. C. 505 West 1st Avenue
WACO P. O. Box 887
WINNIPEG 576 Wall Street
HAVANA - MAYAGUEZ, PUERTO RICO - BOGOTA
CARACAS MEXICO CITY



Consulting Engineers

SPECIALIZING IN THE FIELD OF

WATER & SEWAGE WORKS

ALBRIGHT & FRIEL, INC.
Consulting Engineers
Water, Sewage and Industrial Waste Problems — Airfields, Refuse Incinerators, Power Plants — Industrial Buildings
City Planning - Reports - Valuations
Laboratory
1528 Walnut Street, Philadelphia 2

Bowe, Albertson & Associates
ENGINEERS
Sewerage—Sewage Treatment
Water Supply—Purification
Refuse Disposal—Analyses
Valuations—Reports—Designs
110 Williams St. New York 7, N. Y.
2082 Kings Highway Fairfield, Conn.

Fay, Spofford & Thorndike
Engineers
Charles M. Spofford, John Ayer, Bion A. Bowman, Carroll A. Farwell, Ralph W. Horne, William L. Hyland, Frank L. Lincoln, Howard J. Williams
Water Supply and Distribution — Drainage
Sewerage and Sewage Treatment — Airports
Investigations and Reports
Designs Valuations
Supervision of Construction
Boston New York

Alvord, Burdick & Howson
Engineers
Charles B. Burdick
Louis R. Howson
Donald H. Maxwell
Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation
Civic Opera Building Chicago

Buck, Seifert and Jost
Consulting Engineers
(Formerly Nicholas S. Hill Associates)
Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories
112 East 19th St. New York

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Harrisburg, Pa. New York, N. Y.
Engineers
Water Works, Sewage, Industrial Wastes & Garbage Disposal—Roads, Airports, Bridges & Flood Control. Town Planning, Appraisals, Investigations & Reports.

ARGRAVES & MORT
ENGINEERS
Sewerage and Sewage Treatment
Refuse Disposal—Industrial Wastes
Water Supply and Purification—Dams
70 COLLEGE ST. NEW HAVEN, CONN.

BURNS & McDONNELL ENGINEERING COMPANY
Consulting Engineers 50th Year
Water Works, Light and Power, Sewerage, Rate Investigations, Reports, Designs, Appraisals
P.O. Box 7088, Country Club Sta.; Office, 95th and Troost Avenue, Kansas City 2, Missouri

GILBERT ASSOCIATES, INC.
Engineers, Architects and Consultants
Power Plant Engineering
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service
New York READING Washington

Michael Baker, Jr.
The Baker Engineers
CIVIL ENGINEERS AND PLANNERS
MUNICIPAL ENGINEERS
Airport Design—Sewage Disposal Systems
Water Works Design and Operation
Consulting Services — Surveys and Maps
HOME OFFICE—ROCHESTER, PA.

Camp, Dresser & McKee
Consulting Engineers
6 Beacon Street, Boston 8, Mass.
Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

Ivan M. Glace
Consulting Sanitary Engineer
WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE TREATMENT
Design, Construction and Supervision of Operation
Telephone 5-0407
1001 North Front St. Harrisburg, Pa.

W. H. & L. D. BETZ
CONSULTANTS ON ALL WATER PROBLEMS
Process, Boiler and Municipal Water • Waste and Sewage Treatment • Consultation • Design • Analysis
PHILADELPHIA 24, PENNA.

CAPITOL ENGINEERING CORPORATION
Engineers—Constructors—Management
SEWAGE SYSTEMS — Designs and Surveys, Planning, Bridges
WATER WORKS — Roads and Streets, Airports, Dams
Executive Offices
DILLSBURG, PENNSYLVANIA

WILLIAM A. GOFF, INC.
General Engineering and Consulting Services—Water, Sewerage, Refuse Incineration, Industrial Buildings, Power Plants, Airport, Town Planning Plans, Supervision, Valuations, Reports
Broad St. Station Bldg., Philadelphia 3, Pa.

BLACK & VEATCH
Consulting Engineers
4706 Broadway, Kansas City 2, Mo.
Water Supply Purification and Distribution; Electric Lighting and Power Generation,
Transmission and Distribution; Sewerage and Sewage Disposal; Valuations, Special Investigations and Reports.

The Chester Engineers
Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications, Investigations and Reports, Valuations and Rates.
210 E. Park Way at Sandusky, Pittsburgh 12, Pa.

GREELEY AND HANSEN
Engineers
Samuel A. Greeley, Paul E. Langdon, Thomas M. Niles, Paul Hansen (1920-1944), Kenneth V. Hill, Samuel M. Clarke
Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal
220 S. State Street, Chicago 4

BOGERT-CHILDS ENGINEERING ASSOCIATES
CONSULTING ENGINEERS
Clinton L. Bogert, Howard J. Carlock, John M. Greig, Fred S. Childs
Water Supply and Purification
Sewerage and Sewage Treatment
Flood Control and Drainage
Refuse Disposal
City Planning—Investigations—Reports
624 Madison Avenue, New York 22, N.Y.

DE LEUW, CATHER & COMPANY
Water Supply, Railroads, Sewerage, Highways
Grade Separations—Bridges—Subways
Local Transportation
Investigations — Reports — Appraisals
Plans and Supervision of Construction
150 North Wacker Drive Chicago
79 McAllister Street San Francisco 2, Calif.

Havens & Emerson
W. L. Havens, C. A. Emerson, A. A. Burger, F. C. Tolles, F. W. Jones
Consulting Engineers
Water, Sewage, Garbage, Industrial Wastes, Valuations—Laboratories
Leader Building Cleveland 14
Woolworth Bldg. New York 7

Hayden, Harding & Buchanan

Consulting Engineers

John L. Hayden
John H. Harding — Oscar J. Campia
Waterworks, Sewerage, Civil, Mechanical, Electrical, Structural

826 Park Square Building, Boston, Mass

Nussbaumer and Clarke

Newell L. Nussbaumer — **Irving Clarke**

Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Town Planning

327 Franklin St. — **Buffalo, N. Y.**

J. E. SIRRINE Company

Engineers

Water Supply & Purification
Sewage & Industrial Waste Disposal
Stream Pollution Reports
Utilities, Analyses

Greenville — **South Carolina**

Charles Haydock

Consulting Engineer

Water Works and Sanitation, Industrial Wastes, Design, Construction, Operation and Management. Reports and Valuations.

COMMERCIAL TRUST BUILDING
PHILADELPHIA 2

PARSONS, BRINCKERHOFF, HOGAN & MACDONALD

Engineers

Traffic Reports — Valuations — Harbor Works
Power Developments — Industrial Buildings
Bridges — Tunnels — Subways — Foundations
Dams — Water Works — Sewerage

142 Maiden Lane, New York 7
Calle Sur. 17 No. 27, Caracas, Venezuela
Edificio Suariz Costa, Bogota, Colombia

Benjamin L. Smith & Associates

Engineers

(Formerly Whitman and Smith)

Investigations — Reports
Designs — Supervision — Valuations
Municipal Engineering and Public Utilities

11 North Pearl Street
Albany 7, New York

JONES & HENRY

Consulting Sanitary Engineers

Water Works
Sewerage & Treatment
Waste Disposal

Security Building, — **Toledo 4, Ohio**

Malcolm Pirnie Engineers

Civil & Sanitary Engineers

Malcolm Pirnie — **Ernest W. Whitlock**
Richard Hazen — **G. G. Werner, Jr.**

Investigations, Reports, Plans
Supervision of Construction and Operations
Appraisals and Rates

25 West 43rd St., New York 18, N. Y.

STANLEY ENGINEERING COMPANY

Consulting Engineers

Water Works—Sewerage
Electric Power—Flood Control
Rate Studies—Valuations—Industrial
Airports . . . . . Municipal Buildings

Hershey Bldg., Muscatine, Ia.

ENGINEERING OFFICE OF CLYDE C. KENNEDY

COMPLETE ENGINEERING SERVICE
For More Than a Quarter Century

Investigations, Reports, Design, Supervision of Construction and Operation
Water Supply, Water Conditioning, Sewerage, Sewage and Industrial Waste Treatment

CHEMICAL and BIOLOGICAL LABORATORY
604 Mission Street — **San Francisco, 5**

The Pitometer Company

Engineers

Water Waste Surveys, Trunk Main Surveys, Water Distribution Studies
Penstock Gaugings

New York, 40 Church St.

Philip B. Streander and Affiliates

Consulting Sanitary Engineers

Damon and Foster, Engrs.
Sharon Hill, Del. Co., Pa.

Cleverdon, Varney & Pike, Engrs.
120 Tremont St., Boston 8, Mass.

Water Supply, Treatment, Distribution
Trade Wastes, Refuse Disposal
Sewerage, Sewage Treatment
Plans, Supervision, Reports

Morris Knowles, Inc.

Engineers

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning

1312 Park Building, Pittsburgh, Pa.

LEE T. PURCELL

Consulting Engineer

Water Supply and Purification
Sewerage and Sewage Disposal
Industrial Wastes
Design, Supervision of Construction and Operation
Complete Laboratory Services

1 LEE PLACE
PATERSON 1, NEW JERSEY

Weston & Sampson

Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service
Supervision, Valuations

14 Beacon St. — **Boston, Mass.**

WM. S. LOZIER CO.

Sewerage, Sewage Disposal, Water Supply, Water Purification
Refuse Disposal

Consulting Engineers

10 Gibbs Street — **Rochester 4, N. Y.**

Thomas M. Riddick

Consulting Engineer and Chemist

Municipal and Industrial Water Purification, Sewage Treatment, Plant Supervision, Stream Pollution Investigations, Chemical and Bacteriological Analyses.

369 East 149th Street
New York 55, N. Y.

Whitman & Howard

Engineers (Est. 1869)

Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.

89 Broad St., Boston, Mass.

Metcalf & Eddy

Engineers

Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airfields — Valuations
Laboratory

Statler Building, Boston

ROBERT AND COMPANY ASSOCIATES

INCORPORATED
Architects & Engineers
WASHINGTON • ATLANTA • NEW YORK

WATER SUPPLY • INCINERATORS
SEWAGE DISPOSAL • POWER PLANTS

WHITMAN, REQUARDT AND ASSOCIATES

Engineers — Consultants

Civil—Sanitary—Structural—Mechanical—Electrical. Reports, Plans, Supervision. Appraisals

1304 St. Paul Street
Baltimore 2, Maryland

MOORE & OWEN

Engineers

WATER, SEWAGE, INCINERATION
REFUSE DISPOSAL, AIRFIELDS
COMPLETE WATER & SEWAGE
LABORATORIES, INDUSTRIAL WASTES

1456 N. DELAWARE ST.
INDIANAPOLIS 2, IND.

Russell & Axon

Consulting Engineers

Geo. S. Russell — F. E. Wenger
Joe Williamson, Jr.

Water Works, Sewerage, Sewage Disposal, Power Plants, Appraisals

408 Olive Street — **Municipal Airport**
St. Louis 2, Mo. — **Daytona Beach, Fla.**

THIS SPACE IS AVAILABLE

At reasonable cost to Consulting Engineers interested in reaching both Water and Sewage Works Authorities.
Rates upon request

WATER & SEWAGE WORKS
22 W. Maple St., Chicago
155 E. 44th St., New York

CHEMCO
Equipment

FOR EVERY CHLORINATION AND WATER CONDITIONING PROBLEM

For Your
SEWAGE PLANT

CHEMCO CHLORINATORS are available for every type of installation. The above shows two CHEMCO 100# capacity chlorinator installed for the State of New York. Note use of Aqua-Thermal Coils.

For Your
SWIMMING POOL

CHEMCO has "Everything for the Swimming Pool" from the Filters to the Life Preservers.

For Your
WATER WORKS

A large Chemco Filter Plant installation for the Santa Fe Railroad, Winslow, Arizona. Consult CHEMCO first for your Chlorinator or Water Conditioning Problem.

CHEMICAL EQUIPMENT CO.
1700 NO. MAIN STREET
P. O. Box 3098 Terminal Annex
Los Angeles 54, Calif.
MIDWEST FACTORY BRANCH
205 W. Wacker Drive Chicago 6, Ill.
AGENTS IN PRINCIPAL CITIES

INDEX TO ADVERTISERS

A

Alhydro, Inc. 31A
Allis-Chalmers 10A-11A
American Brass Company, The..... 7A
American Marietta Co. (Valdura Div.) 19A-20A
*American Radiator & Standard Sanitary Corp. 101A
*Antracite Equipment Co..... 103A

B

Badger Meter Mfg. Co..... 30A
*Bailey Meter Co..... 99A
Blaw-Knox Co. 87A
*Builders Iron Foundry..... 83A
*Builders-Providence, Inc. 83A
Byers Co., A. M..... 37A

C

Carborundum Co. 29A
Carter Co., Ralph B..... 87A
Cast Iron Pipe Research Ass'n...8A, 9A
Cement Gun Co..... 93A
Centriline Corp. 39A
Chain Belt Co..... 32A
Chapman Valve Mfg. Co....Second Cover
Chemical Equipment Co..... 108A
Chicago Bridge & Iron Co..... 15A
*Chicago Pump Company..... 3A
Cloroben Corp. 89A
Clow & Sons, Jas. B..... 24A
Columbia Chemical Division..... 43A
Crane Co. 36A

D

Dean & Co., Payne..... 103A
DeLaval Steam Turbine Co..... 6A
Diamond Alkali Company..... 35A
Directory of Engineers.....106A, 107A
Dixie Tank & Bridge Co..... 42A
Dodge Refining Co., Phelps..... 91A
Dolge Co., C. B., The..... 91A
Dorr Co.....Inside Back Cover

E

Eddy Valve Co..... 24A
Edson Corporation, The..... 99A
Everson Mfg. Co..... 99A

F

Fairbanks-Morse 27A
*Fitzgerald, J. C..... 101A
*Flexible Sewer Rod Equipment Co..104A
*Flexible Underground Pipe-Cleaning Co. 104A
Ford Meter Box Co..... 88A

G

General Chemical Div. (Allied Chemical & Dye Corp.)..... 17A
Glauber Brass Mfg. Co..... 94A
*Golden-Anderson Valve Specialty Co. 40A
Grinnell Corp. 33A

H

Hayman & Co., Michael..... 97A
Healy-Ruff Co. 97A
*Hellige, Inc. 97A
*Hooker Electrochemical Co..... 40A
Hydraulic Development Corp..... 99A

I

Industrial Chemical Sales..... 21A
*Infilco, Incorporated 87A
Iowa Valve Co..... 24A

J

*Johns-Manville 14A

L

Layne and Bowler, Inc..... 85A
Leadite Company 95A
*Leopold, F. B..... 97A
*Link Belt Co..... 38A
Littleford Bros. 95A
Lock Joint Pipe Co..... 4A

M

*M. & H. Valve & Fitting Co..... 95A
Mathieson Alkali Co..... 22A
Mathews Hydrants 92A
Meter Specialty Co..... 103A

N

National Clay Pipe Mfrs.' Ass'n.... 16A
National Technical Labs..... 34A
National Water Main Clean. Co..... 105A
Neptune Meter Company..... 44A
Northrop & Co., Inc..... 99A

O

Oakite Co. 99A
*Omega Machine Co..... 98A

P

Pacific Flush-Tank Company..... 25A
Payne Dean & Co..... 103A
Peerless Pump Division..... 90A
Penna. Salt Mfg. Co..... 41A
Phipps & Bird, Inc..... 103A
Photovolt Corp. 89A
*Pittsburgh-Des Moines Steel Co.... 28A
Pittsburgh Pipe Cleaner Co..... 84A
Pittsburgh Plate Glass Co..... 43A
*Proportioners, Inc. 13A

R

Rensselaer Valve Co..... 100A
Ridge Tool Co..... 89A
Roberts Filter Mfg. Co..... 101A
Roots-Connersville Blower Corp..... 86A
*Ross Valve Mfg. Company..... 91A
Royer Fdry. & Mach. Co..... 96A
*R-S Products Corp..... 26A

S

Smith Mfg. Co., A. P..... 18A
Speelmon Elevated Tank Service.... 99A

T

Taylor & Co., W. A..... 97A
Thomson Meter Co..... 44A

U

*U. S. Pipe & Fdry. Co..... 12A

V

*Vapor Recovery Systems Co..... 102A

W

*Wallace & Tiernan Co., Inc...Back Cover
Warren Foundry & Pipe Corp..... 93A
Weston, L. A..... 103A
Wood Company, R. D..... 92A

Y

Yeomans Bros. Co..... 22A

Z

Zeolite Chemical Co..... 101A

*Advertisers with * were represented in the April, 1948, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on behalf of their products.

WHEN SPECIFYING CLARIFIERS FOR SEWAGE TREATMENT...

Why buy Dorr?

1 { BECAUSE Dorr Clarifier first cost is economical . . . as demonstrated by competitive bids.

2 { BECAUSE Dorr Clarifier performance is equal to or better than that of others . . . as clearly shown by extensive operating results.

3 { BECAUSE Dorr Clarifier maintenance costs are far below those of others . . . as proven by actual records from 135 Dorr units showing an average maintenance cost of $5.91 per unit per year over a 11.4 year period.

These three points . . . low first cost, efficient performance and minimum maintenance cost . . . comprise the yardstick by which Clarifier value is measured. When you buy Dorr, you buy full measure in all three.

DORR

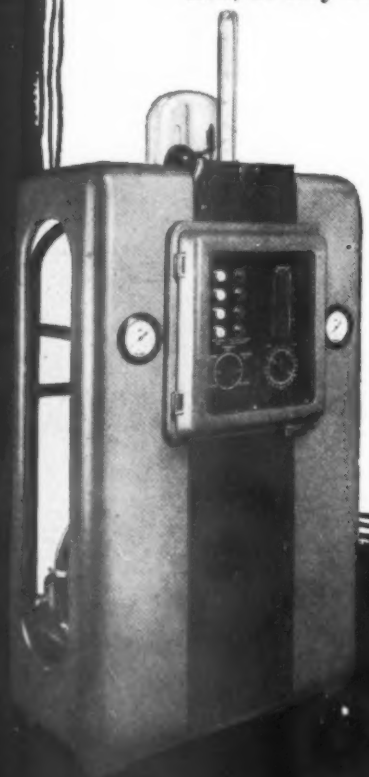
RESEARCH [illegible] ENGINEERING [illegible] EQUIPMENT

DORRCO

THE DORR COMPANY, ENGINEERS
570 LEXINGTON AVE., NEW YORK 22, N. Y.
ATLANTA • TORONTO • CHICAGO
DENVER • LOS ANGELES
RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.
SUGAR PROCESSING
PETREE & DORR DIVISION, NEW YORK 22, N. Y.
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

need a wildcat tamer?

Unless your sewage plant is different from most, you have plenty of wildcats — ODORS, SLUDGE BULKING, B.O.D., HYDROGEN SULFIDE, FOAMING, UNSTABLE EFFLUENT and many others. But like progressive plants everywhere, you can change many of your "cats" from wild to mild by properly applied chlorination, at only a fraction of total plant cost — usually about 1%.



Your W&T Representative is a proficient wildcat tamer with over thirty years of experience and a variety of equipment, who will be glad to help you with your "taming." You'll be particularly interested in the new Program Controlled Sewage Chlorinator developed specifically for sewage plant problems. Write for details today, on sewage chlorination — the *little* investment for *big* advantages.

New... *Program Controlled Sewage Chlorinator. Remote or integral injector. Manual or automatic program operation to meet all sewage flow demands.*

"THE ONLY SAFE SEWAGE IS A STERILIZED SEWAGE"

S-22